FREIGHTLINER®

Run Smart™

HEAVY-DUTY TRUCKS



Maintenance Manual

FREIGHTLINER

Run Smart™

HEAVY-DUTY TRUCKS MAINTENANCE MANUAL

Models: FLA COE
FLB COE
FLC 112 Conventional
FLD Conventional
FLL COE

STI-329-1 (10/09P)

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Foreword

When performed on a regular basis, lubricating the parts of your vehicle is the least costly way of obtaining safe and reliable vehicle operation. Added benefits and savings occur when you check that the engine, undercarriage, and noise emission control parts are in good working order during lubrication.

IMPORTANT: The maintenance operations in this manual are **not all-inclusive**. Also refer to other component and body manufacturers' instructions for specific inspection and maintenance instructions.

Perform the operations in this maintenance manual at scheduled intervals. Perform the pretrip and post-trip inspections, and daily/weekly/monthly maintenance, as outlined in the vehicle driver's manual. Major components, such as engines, transmissions, and rear axles, are covered in their own maintenance and operation manuals, that are provided with the vehicle. Perform any maintenance operations listed at the intervals scheduled in those manuals. Your Freightliner Dealership has the qualified technicians and equipment to perform this maintenance for you. They can also set up a scheduled maintenance program tailored specifically to your needs. Optionally, they can assist you in learning how to perform these maintenance procedures.

IMPORTANT: Descriptions and specifications in this manual were in effect at the time of printing. Freightliner Trucks reserves the right to discontinue models and to change specifications or design at any time without notice and without incurring obligation. Descriptions and specifications contained in this publication provide no warranty, expressed or implied, and are subject to revision and editions without notice.

Refer to www.Daimler-TrucksNorthAmerica.com and www.FreightlinerTrucks.com for more information, or contact Daimler Trucks North America LLC at the address below.

Environmental Concerns and Recommendations

Whenever you see instructions in this manual to discard materials, you should attempt to reclaim and recycle them. To preserve our environment, follow appropriate environmental rules and regulations when disposing of materials.

NOTICE: Parts Replacement Considerations

Do not replace suspension, axle, or steering parts (such as springs, wheels, hubs, and steering gears) with used parts. Used parts may have been subjected to collisions or improper use and have undetected structural damage.

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Descriptions of Service Publications

Daimler Trucks North America LLC distributes the following major service publications in paper and electronic (via ServicePro®) formats.

Workshop/Service Manual

Workshop/service manuals contain service and repair information for all vehicle systems and components, except for major components such as engines, transmissions, and rear axles. Each workshop/service manual section is divided into subjects that can include general information, principles of operation, removal, disassembly, assembly, installation, and specifications.

Maintenance Manual

Maintenance manuals contain routine maintenance procedures and intervals for vehicle components and systems. They have information such as lubrication procedures and tables, fluid replacement procedures, fluid capacities, specifications, and procedures for adjustments and for checking the tightness of fasteners. Maintenance manuals do not contain detailed repair or service information.

Driver's/Operator's Manual

Driver's/operator's manuals contain information needed to enhance the driver's understanding of how to operate and care for the vehicle and its components. Each manual contains a chapter that covers pretrip and post-trip inspections, and daily, weekly, and monthly maintenance of vehicle components. Driver's/operator's manuals do not contain detailed repair or service information.

Service Bulletins

Service bulletins provide the latest service tips, field repairs, product improvements, and related information. Some service bulletins are updates to information in the workshop/service manual. These bulletins take precedence over workshop/service manual information, until the latter is updated; at that time, the bulletin is usually canceled. The service bulletins manual is available only to dealers. When doing service work on a vehicle system or part, check for a valid service bulletin for the latest information on the subject.

IMPORTANT: Before using a particular service bulletin, check the current service bulletin validity list to be sure the bulletin is valid.

Parts Technical Bulletins

Parts technical bulletins provide information on parts. These bulletins contain lists of parts and BOMs needed to do replacement and upgrade procedures.

Web-based repair, service, and parts documentation can be accessed using the following applications on the AccessFreightliner.com website.

ServicePro

ServicePro® provides Web-based access to the most up-to-date versions of the publications listed above. In addition, the Service Solutions feature provides diagnostic assistance with Symptoms Search, by connecting to a large knowledge base gathered from technicians and service personnel. Search results for both documents and service solutions can be narrowed by initially entering vehicle identification data.

PartsPro

PartsPro® is an electronic parts catalog system, showing the specified vehicle's build record.

EZWiring

EZWiring™ makes Freightliner, Sterling, Western Star, Thomas Built Buses, and Freightliner Custom Chassis Corporation products' wiring drawings and floating pin lists available online for viewing and printing. EZWiring can also be accessed from within PartsPro.

Descriptions of Service Publications

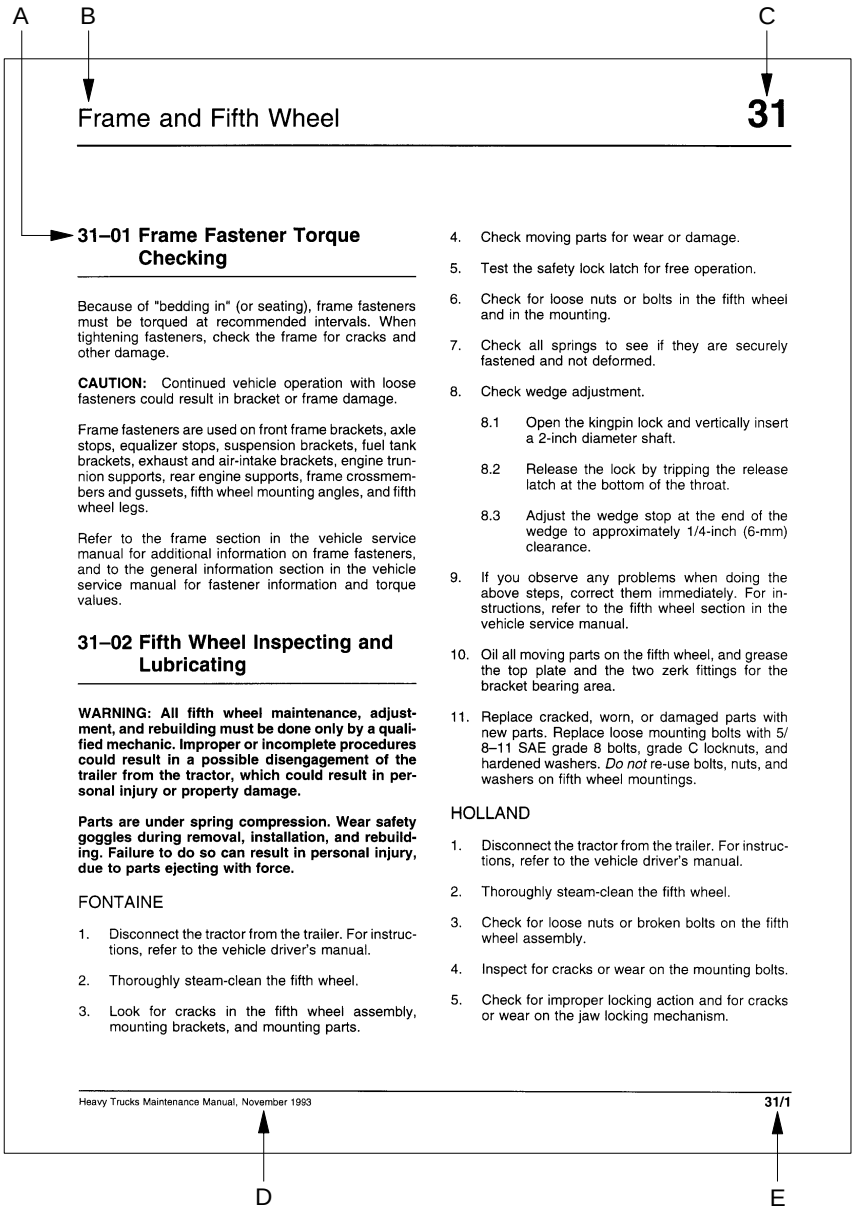
Warranty-related service information available on the AccessFreightliner.com website includes the following documentation.

Recall Campaigns Recall campaigns cover situations that involve service work or replacement of parts in connection with a recall notice. These campaigns pertain to matters of vehicle safety. All recall campaigns are distributed to dealers; customers receive notices that apply to their vehicles.

Field Service Campaigns Field service campaigns are concerned with non-safety-related service work or replacement of parts. All field service campaigns are distributed to dealers; customers receive notices that apply to their vehicles.

Page Description

For an example of a *Heavy-Duty Trucks Maintenance Manual* page, see **Fig. 1**.



11/28/2001 f020034

A. Maintenance Operation Number consists of Group Number followed by Sequence Number
B. Group Title
C. Group Number
D. Release Date
E. Group/Page Number

Fig. 1, Example of a Heavy-Duty Trucks Maintenance Manual Page

Maintenance Manual Contents

Group No.	Group Title
00	General Information
01	Engine
09	Air Intake
13	Air Compressor
15	Alternators and Starters
20	Engine Cooling/Radiator
25	Clutch
26	Transmission
31	Frame and Frame Components
32	Suspension
33	Front Axle
35	Rear Axle
40	Wheels and Tires
41	Driveline
42	Brakes
46	Steering
47	Fuel
49	Exhaust
54	Electrical, Instruments, and Controls
60	Cab
72	Doors
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Determining Scheduled Maintenance Intervals

Performing regular maintenance on your Freightliner vehicle will help ensure that your vehicle delivers safe reliable service and optimum performance for years to come. Failure to follow a regular maintenance program can result in inefficient operation and unscheduled down time.

To determine the correct maintenance intervals for your vehicle you must first determine the type of service or conditions in which the vehicle will operate. Generally, most vehicles operate under conditions that fall within one of the three types of service described. Before placing your new vehicle in service, determine the type of service (Service Schedule I, II, or III) that applies to the intended use of the vehicle. After determining the vehicle's type of service, refer to the Maintenance Service Table or the Vehicle Maintenance Schedule Tables, to determine how often maintenance should be performed.

When the vehicle reaches the distance given for a maintenance interval, see the applicable Maintenance Interval Operations Table for a list of the maintenance operations to be performed at that maintenance interval. Use the maintenance operation numbers to find detailed instructions in the manual on each operation.

Types of Service

Service Schedule I (severe service) applies to vehicles that annually travel less than 6000 miles (10 000 kilometers) *or* that operate under severe conditions. Examples of severe service, Schedule I usage include: operation on extremely poor roads or where there is heavy dust accumulation; constant exposure to extreme hot, cold, salt-air, or other extreme climates; frequent short-distance travel; construction-site operation; city operation (fire truck); or farm operation.

Service Schedule II (short-haul transport) applies to vehicles that annually travel less than 60,000 miles (100 000 kilometers) and operate under normal conditions. Examples of Schedule II usage are: operation primarily in cities and densely populated areas; local transport with infrequent freeway travel; or high percentage of stop-and-go travel.

Service Schedule III (long-haul transport) is for vehicles that annually travel *more than* 60,000 miles (100 000 kilometers) with minimal city or stop-and-go operation. Examples of Schedule III usage are: regional delivery that is mostly freeway miles; interstate transport; or any road operation with high annual mileage.

NOTE: Maintenance instructions in this manual are based on average vehicle use and normal operating conditions. Unusual vehicle operating conditions may require service at more frequent intervals.

Maintenance Service Table: 00–02

Maintenance Service Table

Service Schedule	Maintenance Interval Operation	Maintenance Intervals			
		Frequency	Miles	km	Hours
Schedule I* (Severe Service) vehicles that annually travel less than 6000 miles (10 000 km)	Initial Maintenance (IM)	first	1000	1600	100
	Maintenance 1 (M1)	every	1000	1600	100
	Maintenance 2 (M2)	every	5000	8000	500
	Maintenance 3 (M3)	every	10,000	16 000	1000
	Maintenance 4 (M4)	every	20,000	32 000	2000
Schedule II† (Short-Haul Transport) vehicles that annually travel less than 60,000 miles (100 000 km)	Initial Maintenance (IM)	first	9000 to 10,000	15 000	
	Maintenance 1 (M1)	every	9000 to 10,000	15 000	
	Maintenance 2 (M2)	every	37,000 to 38,000	60 000	—
	Maintenance 3 (M3)	every	75,000	120 000	
	Maintenance 4 (M4)	every	150,000	240 000	
Schedule III† (Long-Haul Transport) vehicles that annually travel over 60,000 miles (100 000 km)	Initial Maintenance (IM)	first	12,500	20 000	
	Maintenance 1 (M1)	every	12,500	20 000	
	Maintenance 2 (M2)	every	50,000	80 000	—
	Maintenance 3 (M3)	every	100,000	160 000	
	Maintenance 4 (M4)	every	300,000	480 000	

* For Schedule I (severe service) vehicles equipped with an hourmeter, use maintenance intervals based on hours of operation rather than distance traveled.

† Use Schedule I (severe service) maintenance intervals for vehicles that operate under severe conditions, such as extremely poor roads, heavy dust accumulation, extreme climate, frequent short distance travel, construction-site operation, city operation (garbage truck), or farm operation.

Vehicle Maintenance Schedule Tables: 00–03

1st through 20th Maintenance for Service Schedule I Vehicles

Maint. No.	Required Maintenance Operation Interval	Service Date	Service I		
			Miles	km	Hours
1st	Initial Maintenance (IM)/M1		1000	1600	100
2nd	M1		2000	3200	200
3rd	M1		3000	4800	300
4th	M1		4000	6400	400
5th	M1 and M2		5000	8000	500
6th	M1		6000	9600	600
7th	M1		7000	11 200	700
8th	M1		8000	12 800	800
9th	M1		9000	14 400	900
10th	M1, M2, and M3		10,000	16 000	1000
11th	M1		11,000	17 600	1100
12th	M1		12,000	19 200	1200
13th	M1		13,000	20 800	1300
14th	M1		14,000	22 400	1400
15th	M1 and M2		15,000	24 000	1500
16th	M1		16,000	25 600	1600
17th	M1		17,000	27 200	1700
18th	M1		18,000	28 800	1800
19th	M1		19,000	30 400	1900
20th	M1, M2, M3, and M4		20,000	32 000	2000

21st through 40th Maintenance for Service Schedule I Vehicles

Maint. No.	Required Maintenance Operation Interval	Service Date	Service I		
			Miles	km	Hours
21st	M1		21,000	33 600	2100
22nd	M1		22,000	35 200	2200
23rd	M1		23,000	36 800	2300
24th	M1		24,000	38 400	2400
25th	M1 and M2		25,000	40 000	2500
26th	M1		26,000	41 600	2600
27th	M1		27,000	43 200	2700
28th	M1		28,000	44 800	2800
29th	M1		29,000	46 400	2900
30th	M1, M2, and M3		30,000	48 000	3000
31st	M1		31,000	49 600	3100

Vehicle Maintenance Schedule Tables: 00–03

Maint. No.	Required Maintenance Operation Interval	Service Date	Service I		
			Miles	km	Hours
32nd	M1		32,000	51 200	3200
33rd	M1		33,000	52 800	3300
34th	M1		34,000	54 400	3400
35th	M1 and M2		35,000	56 000	3500
36th	M1		36,000	57 600	3600
37th	M1		37,000	59 200	3700
38th	M1		38,000	60 800	3800
39th	M1		39,000	62 400	3900
40th	M1, M2, M3, and M4		40,000	64 000	4000

41st through 60th Maintenance for Service Schedule I Vehicles

Maint. No.	Required Maintenance Operation Interval	Service Date	Service I		
			Miles	km	Hours
41st	M1		41,000	65 600	4100
42nd	M1		42,000	67 200	4200
43rd	M1		43,000	68 800	4300
44th	M1		44,000	70 400	4400
45th	M1 and M2		45,000	72 000	4500
46th	M1		46,000	73 600	4600
47th	M1		47,000	75 200	4700
48th	M1		48,000	76 800	4800
49th	M1		49,000	78 400	4900
50th	M1, M2, and M3		50,000	80 000	5000
51st	M1		51,000	82 000	5100
52nd	M1		52,000	83 700	5200
53rd	M1		53,000	85 300	5300
54th	M1		54,000	86 900	5400
55th	M1 and M2		55,000	88 500	5500
56th	M1		56,000	90 100	5600
57th	M1		57,000	91 700	5700
58th	M1		58,000	93 300	5800
59th	M1		59,000	94 900	5900
60th	M1, M2, M3, and M4		60,000	96 500	6000

61st through 80th Maintenance for Service Schedule I Vehicles

Maint. No.	Required Maintenance Operation Interval	Service Date	Service I		
			Miles	km	Hours
61st	M1		61,000	98 200	6100
62nd	M1		62,000	99 800	6200
63rd	M1		63,000	101 400	6300
64th	M1		64,000	103 000	6400
65th	M1 and M2		65,000	104 600	6500
66th	M1		66,000	106 200	6600
67th	M1		67,000	107 800	6700
68th	M1		68,000	109 400	6800
69th	M1		69,000	111 000	6900
70th	M1, M2, and M3		70,000	112 700	7000
71st	M1		71,000	114 300	7100
72nd	M1		72,000	115 900	7200
73rd	M1		73,000	117 500	7300
74th	M1		74,000	119 100	7400
75th	M1 and M2		75,000	120 700	7500
76th	M1		76,000	122 300	7600
77th	M1		77,000	123 900	7700
78th	M1		78,000	125 500	7800
79th	M1		79,000	127 100	7900
80th	M1, M2, M3, and M4		80,000	128 700	8000

81st through 100th Maintenance for Service Schedule I Vehicles

Maint. No.	Required Maintenance Operation Interval	Service Date	Service I		
			Miles	km	Hours
81st	M1		81,000	130 400	8100
82nd	M1		82,000	132 000	8200
83rd	M1		83,000	134 000	8300
84th	M1		84,000	135 200	8400
85th	M1 and M2		85,000	137 000	8500
86th	M1		86,000	138 400	8600
87th	M1		87,000	140 000	8700
88th	M1		88,000	141 600	8800
89th	M1		89,000	143 200	8900
90th	M1, M2, and M3		90,000	144 800	9000
91st	M1		91,000	146 500	9100

Vehicle Maintenance Schedule Tables: 00–03

Maint. No.	Required Maintenance Operation Interval	Service Date	Service I		
			Miles	km	Hours
92nd	M1		92,000	148 100	9200
93rd	M1		93,000	150 000	9300
94th	M1		94,000	151 300	9400
95th	M1 and M2		95,000	153 000	9500
96th	M1		96,000	155 000	9600
97th	M1		97,000	156 100	9700
98th	M1		98,000	157 700	9800
99th	M1		99,000	159 300	9900
100th	M1, M2, M3, and M4		100,000	160 900	10 000

1st through 16th Maintenance for Service Schedule II Vehicles

Maint. No.	Required Maintenance Operation Interval	Service Date	Miles	km
1st	Initial Maintenance (IM)/M1		10,000	16 000
2nd	M1		19,000	30 000
3rd	M1		28,000	45 000
4th	M1 and M2		38,000	60 000
5th	M1		47,000	75 000
6th	M1		56,000	90 000
7th	M1		66,000	105 000
8th	M1, M2, and M3		75,000	120 000
9th	M1		84,000	135 000
10th	M1		94,000	150 000
11th	M1		103,000	165 000
12th	M1 and M2		112,000	180 000
13th	M1		122,000	195 000
14th	M1		131,000	210 000
15th	M1		141,000	225 000
16th	M1, M2, M3, and M4		150,000	240 000

1st through 24th Maintenance for Service Schedule III Vehicles

Vehicle Maintenance Schedule for Service Schedule III				
Maint. No.	Required Maintenance Operation Interval	Service Date	Miles	km
1st	Initial Maintenance (IM)/M1		12,500	20 000
2nd	M1		25,000	40 000
3rd	M1		37,000	60 000

Vehicle Maintenance Schedule Tables: 00–03

Vehicle Maintenance Schedule for Service Schedule III				
Maint. No.	**Required Maintenance Operation Interval**	**Service Date**	**Miles**	**km**
4th	M1 and M2		50,000	80 000
5th	M1		62,000	100 000
6th	M1		75,000	120 000
7th	M1		87,000	140 000
8th	M1, M2, and M3		100,000	160 000
9th	M1		112,000	180 000
10th	M1		125,000	200 000
11th	M1		137,000	220 000
12th	M1 and M2		150,000	240 000
13th	M1		162,000	260 000
14th	M1		175,000	280 000
15th	M1		187,000	300 000
16th	M1, M2, and M3		200,000	320 000
17th	M1		212,000	340 000
18th	M1		225,000	360 000
19th	M1		237,000	380 000
20th	M1 and M2		250,000	400 000
21st	M1		262,000	420 000
22nd	M1		275,000	440 000
23rd	M1		287,000	460 000
24th	M1, M2, M3, and M4		300,000	480 000

Lubrication and Fluid Level Check: 00–04

Table 1 summarizes all operations that must be performed to complete Lubrication and Fluid Level Check Operation 00–04 called for as an M1 maintenance interval for Service Schedule I, II, and III vehicles.

Maintenance operation numbers given in the table are reference numbers used to help you find detailed instructions in the manual on the lubrication or fluid check.

Maintenance Operation 00–04, Lubrication and Fluid Level Check for Service at M1		
Maintenance Operation No.	**Operation Description**	**Check**
25–01	Clutch Release Bearing Lubricating	
25–02	Clutch Release Cross-Shaft Lubricating	
25–03	Clutch Linkage Components Lubricating	
26–01	Shift Control Telescoping Tubes Lubricating and Inspecting, FLA/FLB	
26–02	Shift Control Latch Lubricating and Cylinder Inspecting, FLA/FLB	
26–04	Selection Lever and Pivot Rod Ball Stud Lubricating, FLA/FLB	
26–08	Transmission Oil Level Checking and Breather Checking	
31–02	Fifth Wheel Lubricating	
31–05	Trailer Electrical Connector Lubricating	
32–02	Suspension Lubricating	
33–01	Knuckle Pin Lubricating	
33–02	Tie-Rod End Inspecting and Lubricating	
35–01	Axle Breather and Lubricant Level Checking	
41–02	Driveline Lubricating	
42–03	Manual/Automatic Slack Adjuster Lubricating and Checking (All Models)	
46–01	Steering Driveline Lubricating	
46–02	Ross Manual Steering Gear Lubricant Checking, Model 503	
46–04	Drag Link and Power Steering Cylinder Lubricating	
46–05	Power Steering Reservoir Fluid Level Checking	
46–08	Ross Power Steering Gear Lubricating, TAS Series	
46–09	Sheppard Power Steering Gear Bearing Cap Lubricating	
60–01	Cab-Tilt System Checking, FLA/FLB	
72–01	Door Seal, Door Latch, and Door Hinge Lubricating	

Table 1, Maintenance Operation 00-04, Lubrication and Fluid Level Check for Service Schedules I, II, and III

Maintenance Operation Sets Table: 00–05

IMPORTANT: At each Maintenance Operation Set, in addition to the maintenance operations listed in this table, perform all daily, weekly, and monthly maintenance operations listed in the "Pretrip and Post-Trip Inspections and Maintenance" chapter of the vehicle driver's manual.

NOTE: Maintenance operations appearing in italics in this table are for noise emission control components. Numbers in this table are reference numbers matching those in the text of this manual.

Maintenance Operation Sets for Groups 00 through 83

Maint. Oper. No.	Operation Description	Maintenance Interval				
		IM	M1	M2	M3	M4
01–01	*Engine Rear-Support Assembly Checking*				•	•
01–02	*Engine Noise Panel Inspecting*				•	•
01–03	Jacobs Engine Brake Wiring Inspecting			•	•	•
01–04	Engine Drive Belt Inspecting				•	•
09–01	Air Cleaner Element Inspecting and Replacing				•	•
13–01	Bendix Air Compressor Inspecting	•	•	•	•	•
15–01	Alternator, Battery, and Starter Checking	•			•	•
20–01	Radiator Cap Checking			•	•	•
20–02	Radiator Pressure Flushing and Coolant Changing					•
20–03	*Fan Drive and Clutch Checking*			•	•	•
25–01	Clutch Release Bearing Lubricating	•	•	•	•	•
25–02	Clutch Release Cross-Shaft Lubricating	•	•	•	•	•
25–03	Clutch Linkage Components Lubricating	•	•	•	•	•
26–01	Shift Control Telescoping Tubes Lubricating and Inspecting, FLA/FLB	•	•	•	•	•
26–02	Shift Control Latch Lubricating and Cylinder Inspecting, FLA/FLB	•	•	•	•	•
26–03	Shift Lever Pivot Yokes Inspecting, FLA/FLB				•	•
26–04	Selection Lever and Pivot Rod Ball Stud Lubricating, FLA/FLB	•	•	•	•	•
26–05	Allison Transmission Fluid and Filter Changing					•
26–06	Manual Transmission Magnetic Plug Cleaning, Oil Changing, and Oil Filter Element Changing	•		•	•	•
26–07	Transmission Air Filter/Regulator Checking, and Cleaning or Replacing			•	•	•
26–08	Transmission Oil Level Checking and Breather Checking	•	•			
31–01	Fifth Wheel Inspecting	•	•	•	•	•
31–02	Fifth Wheel Lubricating	•	•	•	•	•
31–03	Frame Fastener Torque Checking	•				
31–04	Holland Fifth Wheel Sliding Mechanism Inspecting			•	•	•
31–05	Trailer Electrical Connector Lubricating	•	•	•	•	•
32–01	Suspension Inspecting	•	•	•	•	•
32–02	Suspension Lubricating	•	•	•	•	•
32–03	Suspension U-bolt Torque Checking	•			•	•

Maintenance Operation Sets Table: 00–05

Maint. Oper. No.	Operation Description	Maintenance Interval				
		IM	M1	M2	M3	M4
33–01	Knuckle Pin Lubricating	•	•	•	•	•
33–02	Tie-Rod End Inspecting and Lubricating	•	•	•	•	•
33–03	All-Axle Alignment Checking	•				
35–01	Axle Breather and Lubricant Level Checking		•	•	•	•
35–02	Axle Lubricant Changing, Oil Filter Replacing and Magnetic Strainer Cleaning	•			•	•
40–01	Wheel Nut and Rim Nut Checking			•	•	•
41–01	Driveline Inspecting	•	•	•	•	•
41–02	Driveline Lubricating	•	•	•	•	•
42–01	Brake Adjusting—Cam Brakes with Manual Slack Adjusters	•	•	•	•	•
42–02	Camshaft Bracket Bushing Lubricating			•	•	•
42–03	Manual/Automatic Slack Adjuster Lubricating and Checking (All Models)	•	•	•	•	•
42–04	Meritor Automatic Slack Adjuster Inspecting			•	•	•
42–05	Wedge Brake Checking	•	•	•	•	•
42–06	Wedge Brake Inspecting and Lubricating				•	•
42–07	Alcohol Evaporator Checking			•	•	•
42–08	Bendix Alcohol Evaporator Cleaning			•	•	•
42–09	Bendix Alcohol Evaporator Gasket Replacing				•	•
42–10	Bendix Air Dryer Checking (AD–2, AD–4, or AD–9)				•	•
42–11	Bendix Air Dryer or Anchorlok Aftercooler Inspecting (Bendix AD–2, AD–4, AD–9, or Anchorlok)	•	•	•	•	•
42–12	Bendix Air Dryer Desiccant Replacing (AD–2)					•
42–13	Bendix Air Dryer Desiccant Replacing (AD–4 or AD–9)					•
42–14	CR Brakemaster Air Dryer Cleaning (Model 62 or 68)	•	•	•	•	•
42–15	Anchorlok Aftercooler Automatic Ejector Valve Clearing			•	•	•
42–16	Bendix Air Brake Valve Operation Checking (BP–R1 and E–12)				•	•
42–17	Bendix Air Brake Valve Disassembly, Cleaning, and Inspecting (BP–1, Double Check Valve, E–6, PP–7, QR–1, R–6, R–14, SR–1, ST–3, TC–7, TP–5, TR–3)				•	•
42–18	Bendix Air Brake Valve Disassembly, Cleaning, Inspecting, and Lubricating (DV–2, PP–3, and Single Check Valve)			•	•	•
42–19	Bendix Air Brake Valve Inspecting and Testing (BP–1, BP–R1, LQ–5, PP–7, R–14, and TC–7)				•	•
42–20	Bendix Foot Brake Valve Actuator Lubricating (E–6 or E–12) and Leak-Testing (E–12)				•	•
42–21	Sealco Moisture Ejection Valve Operation- and Leak-Testing (Model 6300)			•	•	•
42–22	Midland Quick Release and Flipper Valve Checking	•	•	•	•	•
42–23	Meritor WABCO System Saver 1000 Air Dryer Desiccant Replacing					•
42–24	Brake Inspection	•	•	•	•	•
46–01	Steering Driveline Lubricating	•	•	•	•	•

Maintenance Operation Sets Table: 00–05

Maint. Oper. No.	Operation Description	Maintenance Interval				
		IM	M1	M2	M3	M4
46–02	Ross Manual Steering Gear Lubricant Checking, Model 503	•	•	•		
46–03	Ross Manual Steering Gear Lubricant Changing, Model 503				•	•
46–04	Drag Link and Power Steering Cylinder Lubricating	•	•	•	•	•
46–05	Power Steering Reservoir Fluid Level Checking	•	•			
46–06	Power Steering Reservoir Fluid and Filter Changing			•	•	•
46–07	Steering Driveline Deck Bearing Lubricating, FLA/FLB			•	•	•
46–08	Ross Power Steering Gear Lubricating, TAS Series	•	•	•	•	•
46–09	Sheppard Power Steering Gear Bearing Cap Lubricating	•	•	•	•	•
47–01	Fuel Tank Vent Checking			•	•	•
47–02	Fuel Tank Band Nut Tightening, FLA, FLB, and FLD	•	•	•	•	•
47–03	Fuel Separator Sight Bowl Cleaning and Element Replacing			•	•	•
49–01	*Exhaust System Inspecting*	•	•	•	•	•
54–01	Electrical System Checking	•			•	•
54–02	Speedometer/Tachometer Cable Lubricating				•	•
60–01	Cab-Tilt System Checking, FLA/FLB	•	•	•	•	•
60–02	Cab-Suspension Spring Center-Bolt Torque Checking, FLC			•	•	•
60–03	Cab Latch Checking, FLA/FLB	•	•	•	•	•
72–01	Door Seal, Door Latch, and Door Hinge Lubricating	•	•	•	•	•
83–01	Air Conditioner Inspecting			•	•	•

Initial Maintenance (IM) Operations: 00–06

IMPORTANT: After performing all operations listed in this table, perform all daily, weekly, and monthly maintenance operations listed in the "Pretrip and Post-Trip Inspections and Maintenance" chapter of the vehicle driver's manual.

NOTE: Numbers in this table are reference numbers matching those in the text of this manual.

Initial Maintenance (IM) Operations for Service Schedules I, II, and III

Initial Maintenance (IM) Operations for Service Schedules I, II, and III		
Maintenance Operation Number	**Operation Description**	**Check**
00–07	Perform all MI Operations	
15–01	Alternator, Battery, and Starter Checking	
26–06	Manual Transmission Magnetic Plug Cleaning, Oil Changing, and Oil Filter Element Changing	
31–03	Frame Fastener Torque Checking	
32–03	Suspension U-bolt Torque Checking	
33–03	All-Axle Alignment Checking	
35–02	Axle Lubricant Changing, Oil Filter Replacing, and Magnetic Strainer Cleaning	
54–01	Electrical System Checking	

M1 Maintenance Interval Operations Table: 00-07

The M1 Maintenance Interval Operations table lists all maintenance operations that are to be performed at the M1 maintenance interval. Maintenance operation numbers are reference numbers used to help you find detailed instructions in this manual on the maintenance operations to be performed.

IMPORTANT: After performing all operations listed in this table, perform all daily, weekly, and monthly maintenance operations listed in the "Pretrip and Post-Trip Inspections and Maintenance" chapter of the vehicle driver's manual.

M1 Maintenance Interval Operations for Service Schedules I, II, and III

M1 Maintenance Interval Operations for Service Schedules I, II, and III		
Maintenance Operation Number	**Operation Description**	**Check**
00–04	Lubrication and Fluid Level Check (includes the following) • Clutch Release Bearing Lubricating • Clutch Release Cross-Shaft Lubricating • Clutch Linkage Components Lubricating • Shift Control Telescoping Tubes Lubricating and Inspecting, FLA/FLB • Shift Control Latch Lubricating and Cylinder Inspecting, FLA/FLB • Selection Lever and Pivot Rod Ball Stud Lubricating, FLA/FLB • Transmission Oil Level Checking and Breather Checking • Fifth Wheel Lubricating • Trailer Electrical Connector Lubricating • Suspension Lubricating, Front and Rear • Knuckle Pin Lubricating • Tie-Rod End Inspecting and Lubricating • Axle Breather and Lubricant Level Checking • Driveline Lubricating • Manual/Automatic Slack Adjuster Lubricating and Checking (All Models) • Steering Driveline Lubricating • Ross Manual Steering Gear Lubricant Checking, Model 503 • Drag Link and Power Steering Cylinder Lubricating • Power Steering Reservoir Fluid Level Checking • Ross Power Steering Gear Lubricating, TAS Series • Sheppard Power Steering Gear Bearing Cap Lubricating • Cab-Tilt System Checking, FLA/FLB • Door Seal, Door Latch, and Door Hinge Lubricating	
13–01	Bendix Air Compressor Inspecting	
31–01	Fifth Wheel Inspecting	
32–01	Suspension Inspecting	
41–01	Driveline Inspecting	
42–01	Brake Adjusting—Cam Brakes With Manual Slack Adjusters	

M1 Maintenance Interval Operations Table: 00-07

M1 Maintenance Interval Operations for Service Schedules I, II, and III		
Maintenance Operation Number	**Operation Description**	**Check**
42–05	Wedge Brake Checking	
42–11	Bendix Air Dryer or Anchorlok Aftercooler Inspecting (Bendix AD–2, AD–4, AD–9, or Anchorlok)	
42–14	CR Brakemaster Air Dryer Cleaning (Model 62 or 68)	
42–22	Midland Quick Release and Flipper Valve Checking	
42–24	Brake Inspection	
47–02	Fuel Tank Band Nut Tightening, FLA, FLB, and FLD	
60–03	Cab Latch Checking, FLA/FLB	
49–01	*Exhaust System Inspecting*	

M2 Maintenance Interval Operations Table: 00-08

The M2 Maintenance Interval Operations table lists all maintenance operations that are to be performed at the M2 maintenance interval. Maintenance operation numbers are reference numbers used to help you find detailed instructions in this manual on the maintenance operations to be performed. Perform all M1 maintenance interval operations at the M2 maintenance interval.

NOTE: Maintenance operations appearing in italics in this table are for noise emission control components. Numbers in this table are reference numbers matching those in the text of this manual.

M2 Maintenance Interval Operations for Service Schedules I, II, and III

M2 Maintenance Interval Operations for Service Schedules I, II, and III		
Maintenance Operation Number	**Operation Description**	**Check**
00–07	Perform all M1 Operations	
01–03	Jacobs Engine Brake Wiring Inspecting	
20–01	Radiator Cap Checking	
20–03	*Fan Drive and Clutch Checking*	
26–06	Manual Transmission Magnetic Plug Cleaning, Oil Changing, and Oil Filter Element Changing	
26–07	Transmission Air Filter/Regulator Checking, and Cleaning or Replacing	
31–04	Holland Fifth Wheel Sliding Mechanism Inspecting	
40–01	Wheel Nut and Rim Nut Checking	
42–02	Camshaft Bracket Bushing Lubricating	
42–04	Meritor Automatic Slack Adjuster Inspecting	
42–07	Alcohol Evaporator Checking	
42–08	Bendix Alcohol Evaporator Cleaning	
42–15	Anchorlok Aftercooler Automatic Ejector Valve Clearing	
42–18	Bendix Air Brake Valve Disassembly, Cleaning, Inspecting, and Lubricating (DV–2, PP–3, and Single Check Valve)	
42–21	Sealco Moisture Ejection Valve Operation- and Leak-Testing (Model 6300)	
46–06	Power Steering Reservoir Fluid and Filter Changing	
46–07	Steering Driveline Deck Bearing Lubricating, FLA/FLB	
47–01	Fuel Tank Vent Checking	
47–03	Fuel Separator Sight Bowl Cleaning and Element Replacing	
60–02	Cab-Suspension Spring Center-Bolt Torque Checking, FLC	
83–01	Air Conditioner Inspecting	

M3 Maintenance Interval Operations Table: 00–09

The M3 Maintenance Interval Operations table lists all maintenance operations that are to be performed at the M3 maintenance interval. Maintenance operation numbers are reference numbers used to help you find detailed instructions in this manual on the maintenance operations to be performed. Perform all maintenance interval operations in M1 and M2 when performing M3 maintenance interval operations.

NOTE: Maintenance operations appearing in italics in this table are for noise emission control components. Numbers in this table are reference numbers matching those in the text of this manual.

M3 Maintenance Interval Operations for Service Schedules I, II, and III

M3 Maintenance Interval Operations for Service Schedules I, II, and III		
Maintenance Operation Number	**Operation Description**	**Check**
00–07	Perform all MI Operations	
00–08	Perform all M2 Operations	
01–01	*Engine Rear-Support Assembly Checking*	
01–02	*Engine Noise Panel Inspecting*	
01–04	Engine Drive Belt Inspecting	
09–01	Air Cleaner Element Inspecting and Replacing	
15–01	Alternator, Battery, and Starter Checking	
26–03	Shift Lever Pivot Yokes Inspecting, FLA/FLB	
32–03	Suspension U-Bolt Torque Checking	
35–02	Axle Lubricant Changing, Oil Filter Replacing, and Magnetic Strainer Cleaning	
42–06	Wedge Brake Inspecting and Lubricating	
42–09	Bendix Alcohol Evaporator Gasket Replacing	
42–10	Bendix Air Dryer Checking (AD–2, AD–4, or AD–9)	
42–16	Bendix Air Brake Valve Operation Checking (BP–R1 and E–12)	
42–17	Bendix Air Brake Valve Disassembly, Cleaning, and Inspecting (BP–1, Double Check Valve, E–6, PP–7, QR–1, R–6, R–14, SR–1, ST–3, TC–7, TP–5, and TR–3)	
42–19	Bendix Air Brake Valve Inspecting and Testing (BP–1, BP–R1, LQ–5, PP–7, R–14 and TC–7)	
42–20	Bendix Foot Brake Valve Actuator Lubricating (E–6 or E–12) and Leak-Testing (E–12)	
46–03	Ross Manual Steering Gear Lubricant Changing, Model 503	
54–01	Electrical System Checking	
54–02	Speedometer/Tachometer Cable Lubricating	

M4 Maintenance Interval Operations Table: 00-10

The M4 Maintenance Interval Operations table lists all maintenance operations that are to be performed at the M4 maintenance interval. Maintenance operation numbers are reference numbers used to help you find detailed instructions in this manual on the maintenance operations to be performed. Perform all maintenance interval operations in M1, M2, and M3 when performing M4 maintenance interval operations.

M4 Maintenance Interval Operations for Service Schedules I, II, and III

M4 Maintenance Interval Operations for Service Schedules I, II, and III		
Maintenance Operation Number	**Operation Description**	**Check**
00–07	Perform all M1 Operations	
00–08	Perform all M2 Operations	
00–09	Perform all M3 Operations	
20–02	Radiator Pressure Flushing and Coolant Changing	
26–05	Allison Transmission Fluid and Filter Changing	
42–12	Bendix Air Dryer Desiccant Replacing (AD–2)	
42–13	Bendix Air Dryer Desiccant Replacing (AD–4 or AD–9)	
42–23	Meritor WABCO System Saver 1000 Air Dryer Desiccant Replacing	

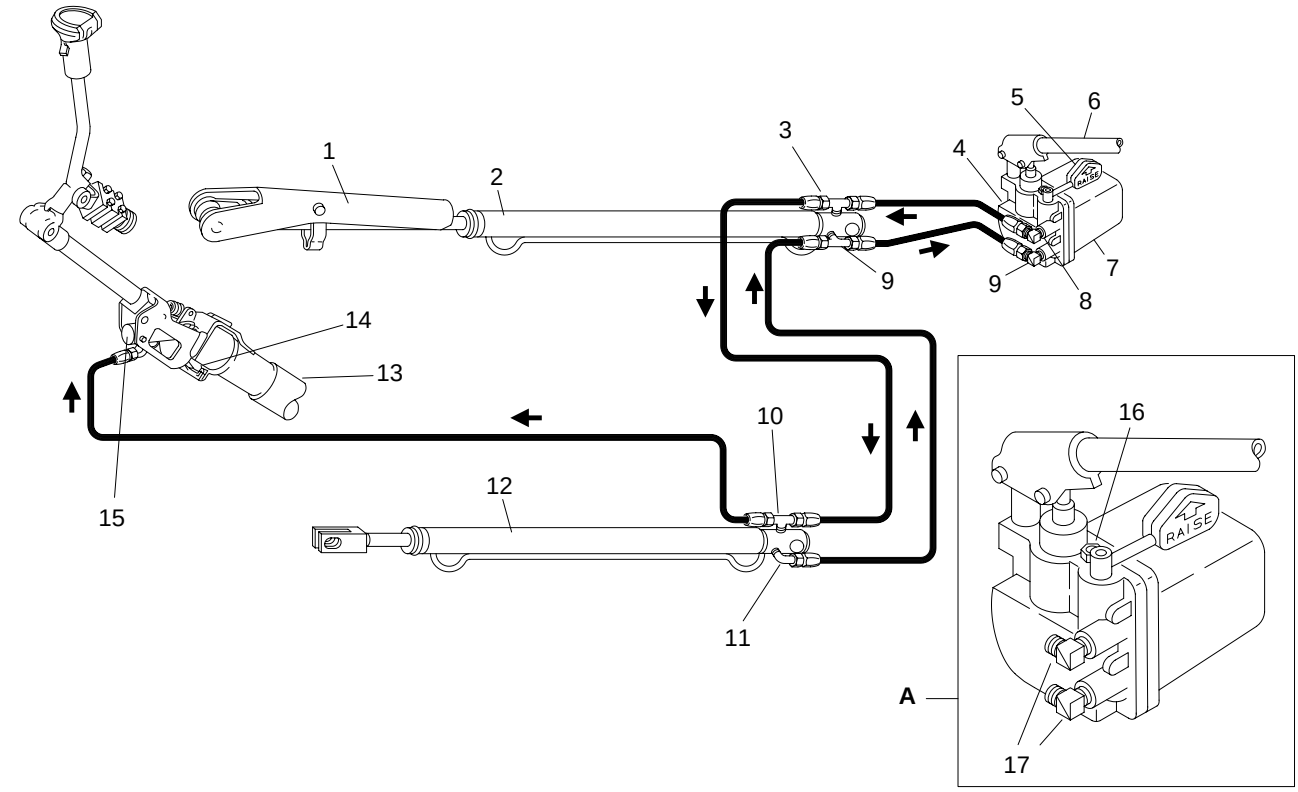
COE Cab Tilting, FLA/FLB: 00–11

Cab-Tilt System

The Power-Packer® cab-tilt system has four major parts (see **Fig. 1**):

- A hydraulic pump consisting of a pump body, a reservoir, and a pump control lever.
- Two hydraulic tilt cylinders that raise and lower the cab.
- A shift-disconnect cylinder that allows the shift tube to extend during cab tilting.
- A tilt strut on the right-side tilt cylinder, which must be used when working under a cab that has not been fully tilted.

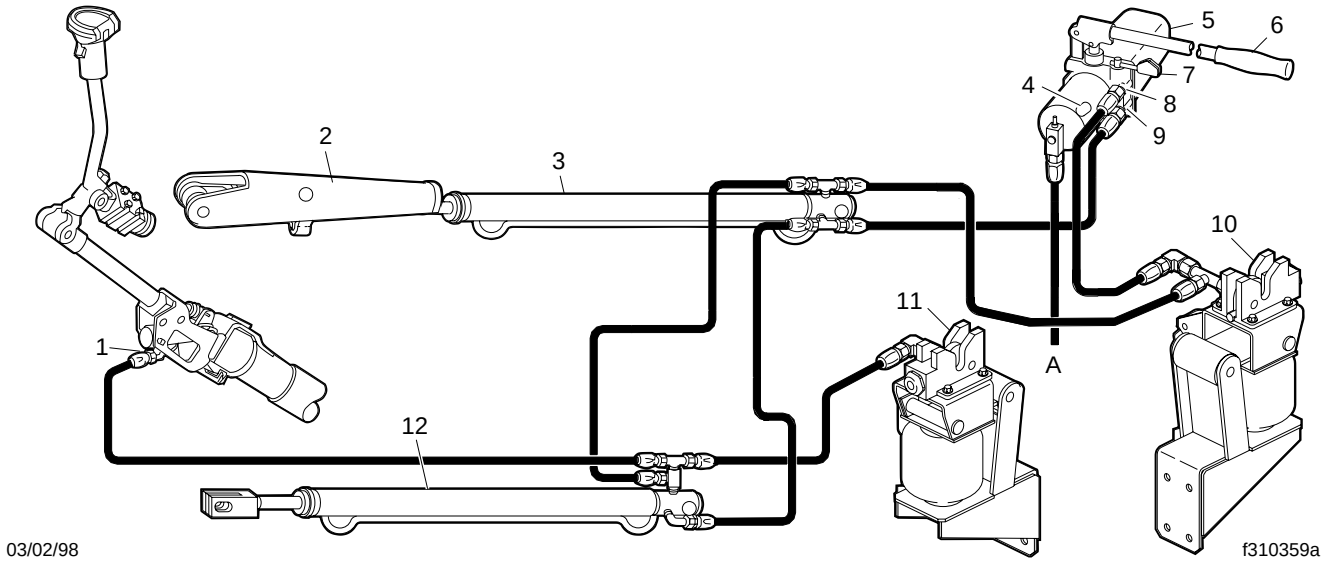
The optional air/hydraulic system has the same major parts as the hydraulic-only system, but has an additional air motor assembly attached to the tilt pump. See **Fig. 2**. The air motor normally operates the tilt pump in place of the manual pump control lever. If for any reason the air motor is not working, the tilt pump can be operated with the manual pump lever.



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A. Tilt Pump Enlargement
1. Tilt Strut
2. Right Tilt Cylinder
3. "Push" Port Fitting
4. Pump Body
5. Pump Control Lever
6. Pump Lever
7. Reservoir
8. "Push" Port Fitting
9. "Pull" Port Fitting
10. "Push" Port Fitting
11. "Pull" Port Fitting
12. Left Tilt Cylinder
13. Shift Tube
14. Shift Tube Latch Mechanism
15. Shift-Disconnect Cylinder
16. Fill Plug
17. Fittings

Fig. 1, Hydraulic-Only System, Equipped With Mechanical Cab Latches



A. Air supply connects here.

1. Shift-Disconnect Cylinder
2. Tilt Strut
3. Right Tilt Cylinder
4. Air Motor Assembly and Button
5. Reservoir
6. Manual Pump Lever
7. Pump Control Lever
8. "Push" Port
9. "Pull" Port
10. Right Hydraulic Cab Latch
11. Left Hydraulic Cab Latch
12. Left Tilt Cylinder

Fig. 2, Optional Air/Hydraulic System, Equipped With Hydraulic Cab Latches and Cab Air Suspension

On FLBs, cab latches are hydraulic, and are plumbed into the cab-tilt system.

The tilt cylinders are connected to the pump by flexible high-pressure lines. Velocity fuses are built into the tilt cylinder ports. They act as check valves to prevent the cab from free-falling in case of hydraulic system damage, such as a ruptured line.

There are two hydraulic circuits in the Power-Packer system: the *push*circuit raises the cab from the lowered position to the desired tilt position, and the *pull* circuit brings the cab from a tilted position up and over center. See **Fig. 3**.

Placing the control lever in the "Raise" position opens the *push* circuit in the hydraulic system. When the mechanical cab-hold-down latches are released and the pump is operated, hydraulic pressure builds in the tilt cylinders and the shift-disconnect cylinder. If equipped with hydraulic cab latches, hydraulic pressure releases the latches. As pressure increases, the shift-disconnect cylinder releases to allow the shift tube to telescope out. Then the tilt cylinder piston rods extend, raising the cab. When the cab goes over center, it falls at a controlled rate to the full-tilt position, automatically relieving hydraulic system pressure.

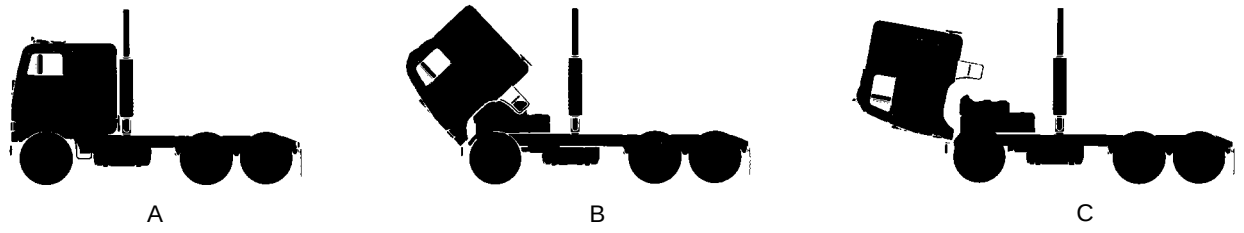
When the control lever is placed in the "Lower" position, the *pull* circuit in the hydraulic system opens. When the pump is operated, hydraulic pressure forces the cab back up and over center. The cab then falls at a controlled rate until it settles onto the rear mounts.

NOTE: Whenever raising or lowering the cab, stop working the pump once the cab goes over center. The cab falls at a controlled rate, and continued pumping could cause hydraulic lock-up of the tilt cylinders.

Hydraulic lock-up of the tilt cylinders can occur during very cold weather. It can also occur when the wrong hydraulic fluid is used, when there is air in the system, when there is sudden cab movement, or when a hydraulic line is ruptured. Any of these situations will cause the velocity fuses to function as safety check valves, and lock up the tilt cylinders.

IMPORTANT: If the tilt cylinders lock up, check for a major problem (such as a ruptured line or

COE Cab Tilting, FLA/FLB: 00–11



A. Lowered (Operating) Position B. 45-Degree-Tilt Position C. Full-Tilt Position (80 Degrees)

Fig. 3

leaking fitting) before trying to unlock the tilt cylinders. If such a problem is found, make any necessary repairs before unlocking the cylinder.

To unlock the cylinders, the cab must be moved in the opposite direction of travel (back toward the 45-degree position). If the cab is moving toward the full-tilt position when the lock-up occurs, move the control lever to "Lower," and work the pump a few strokes to unlock the cylinders. Move the control lever to "Raise," and allow the cab to descend to a full-tilt position. If the cab is moving toward the lowered (operating) position when the lock-up occurs, move the control lever to "Raise," and work the pump a few strokes to unlock the cylinders. Move the control lever to "Lower," and allow the cab to descend to the operating position.

Tilting the FLB Cab

⚠ CAUTION

Before tilting the cab, make sure the vehicle is parked on level ground, both side-to-side and front-to-rear. Tilting the cab while the vehicle is parked on unlevel ground (such as a sloping highway shoulder) may damage the cab mounts and prevent you from returning the cab to the operating position.

1. Apply the parking brakes. Place the transmission shift lever in neutral. Shut down the engine if it is running.

⚠ WARNING

Before tilting the cab, make sure that there is adequate clearance in front of the vehicle, and that the area is free of people and all objects.

Do not tilt the cab with the engine running. Tilting the cab could engage the transmission. If the engine is running, the vehicle can move, causing an accident that could result in personal injury or property damage.

2. Secure all loose articles in the cab and bunk, and make sure the doors are securely latched.

⚠ WARNING

Objects falling in the cab, or a door flying open, could damage the vehicle or cause personal injury.

3. Move the pump control lever to "Raise."
4. Operate the pump (using the manual pump handle, or the air control button if so equipped) to disengage the hold-down latches.

IMPORTANT: Check the indicator pin on each cab latch. The latches have disengaged if the pins are out. See **Fig. 4**.

If air is present in the hydraulic tilt system, pump operation will seem "spongy" or ineffective. If this happens, bleed the air from the system; for instructions, see **Group 60** of the *Heavy-Duty Trucks Service Manual*.

If the cab stops moving while it is being raised, do not force it to move with the tilt pump. The

velocity fuses have locked up the tilt cylinders; unlock them.

WARNING

Make sure the tilt strut is pushed down onto the right tilt-cylinder rod. If the tilt strut is not engaged, and the cab drops, the result could be serious injury or death.

5. When the cab reaches a 30-degree angle, stop working the pump. Push the free end of the tilt strut down onto the right tilt-cylinder rod. See **Fig. 5**. The tilt strut prevents the cab from accidently dropping below this position.

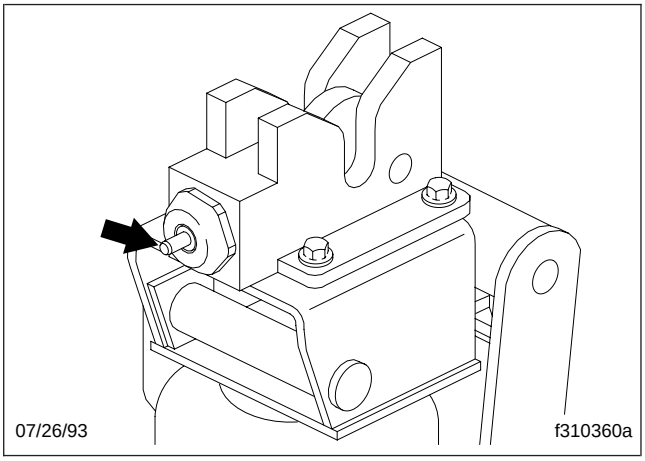


Fig. 4, Cab Latch Indicator Pin

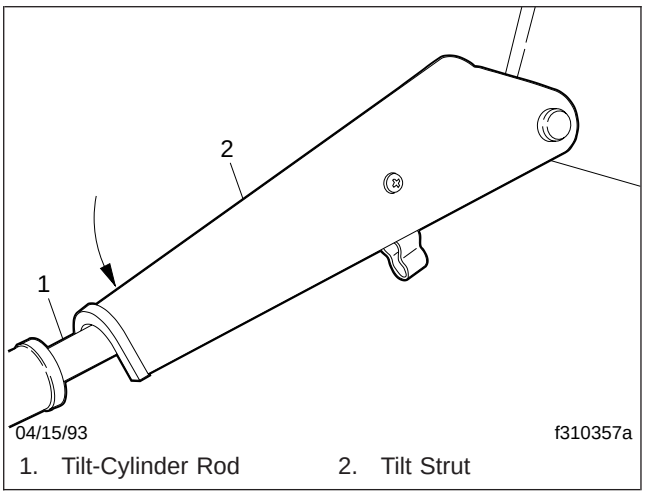


Fig. 5, Tilt Strut Positioning

6. To tilt the cab all the way, continue working the pump until the cab nears a 45-degree angle. Reduce pumping speed. Once the cab goes beyond 45 degrees, stop working the pump. The cab will gently descend to a full-tilt position. To stop the cab at any position between 45-degrees and full-tilt, move the control lever to "Lower."

IMPORTANT: If the cab unintentionally stops after it has gone beyond 45 degrees, do not force it down with the tilt pump. The velocity fuses have locked up the tilt cylinders; unlock them.

Returning the FLB Cab from the Tilted Position

DANGER

Stay completely clear of the cab's travel path at all times. Once the tilt strut has been released, do not lean over the frame rails, the engine, or the transmission for any reason. To do so could result in serious injury or death.

1. Move the tilt strut away from the right tilt-cylinder rod, and lock it in the spring catch.

   If the cab was tilted less than 45 degrees, raise it enough to release the tilt strut. Move the tilt strut away from the tilt-cylinder rod, and lock it in the spring catch before lowering the cab. See **Fig. 6**.

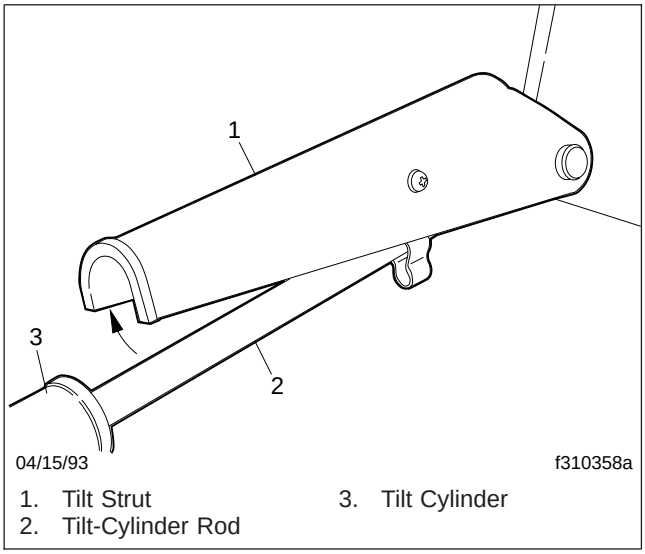


Fig. 6, Releasing the Tilt Strut

2. Set the pump control lever at "Lower," and work the pump until the cab nears a 45-degree angle. Reduce pumping speed. Once the cab goes over center, stop working the pump. The cab will gently descend to the operating position.

   To stop the cab at any position between 45 degrees and 30 degrees, move the control lever to "Raise," and push the tilt strut down onto the right tilt-cylinder rod.

IMPORTANT: If the cab unintentionally stops after it has gone beyond 45 degrees, do not force it down with the tilt pump. The tilt strut is in the locked position, or the velocity fuses have locked the tilt cylinders. Release the tilt strut, or unlock the velocity fuses.

3. When the cab is lowered all the way, make sure the pump control lever is set at "Lower."
4. Check the indicator pin on each cab latch. See **Fig. 4**. The latches are locked when the pins have moved back into the piston and cylinder spring assembly.
5. Push the transmission shift lever forward to lock the shift tube latch mechanism.

NOTE: Maintain the hydraulic fluid level at the oil fill plug. Add fluid only when the cab is in the operating position. Use only Freightliner-approved hydraulic fluid; see **Group 60** for specified fluid.

Tilting the FLA Cab

CAUTION

Before tilting the cab, make sure the vehicle is parked on level ground, both side-to-side and front-to-rear. Tilting the cab while the vehicle is parked on unlevel ground (such as a sloping highway shoulder) may damage the cab mounts and prevent you from returning the cab to the operating position.

1. Apply the parking brakes. Place the transmission shift lever in neutral. Shut down the engine if it is running.

WARNING

Before tilting the cab, make sure that there is adequate clearance in front of the vehicle, and that the area is free of people and all objects.

Do not tilt the cab with the engine running. Tilting the cab could engage the transmission. If the engine is running, the vehicle can move, causing an accident that could result in personal injury or property damage.

2. Remove the pump handle from the baggage compartment, and insert it into the pump shank.
3. Secure all loose articles in the cab and bunk, and make sure the doors are securely latched.

WARNING

Objects falling in the cab, or a door flying open, could damage the vehicle or cause personal injury.

4. Move the pump control lever to "Raise."
5. Unlock the back-of-cab latch handles (**Fig. 7**) by pulling them outward. See **Fig. 8**.

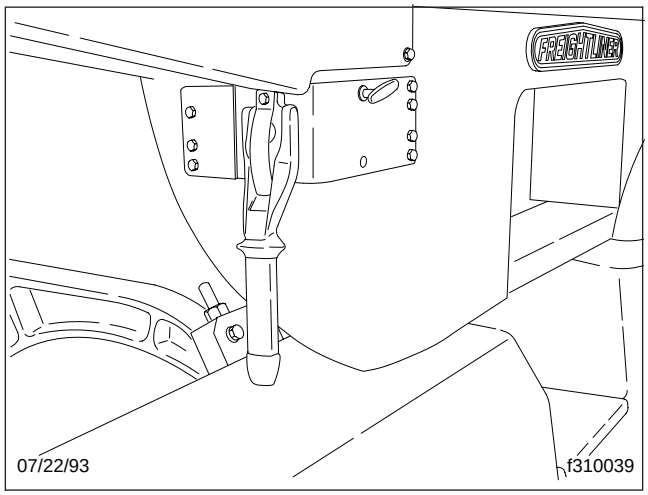


Fig. 7, Latch Handle (Locked Position)

CAUTION

Do not work the tilt pump while the cab latches are locked. Doing this causes stress in the back of the cab, which could cause rivet and cab-skin damage.

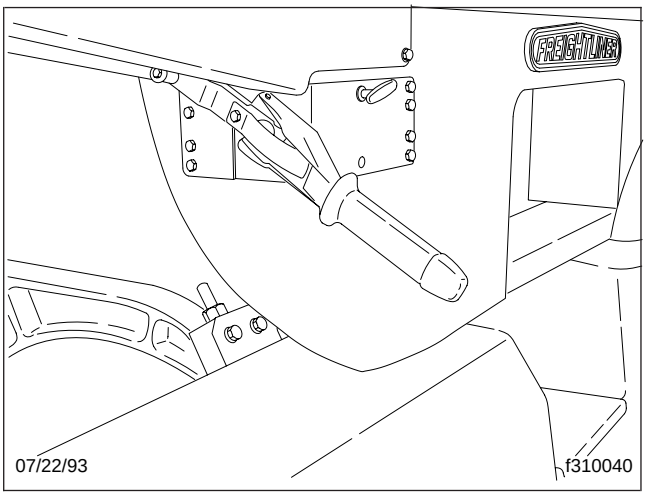


Fig. 8, Latch handle (Unlocked Position)

6. Pull the safety hook release handle (**Fig. 9**) while working the hydraulic pump. If the cab does not begin to raise during the first 10 to 15 strokes, stop what you are doing. Make sure the shift tube latch mechanism has released.

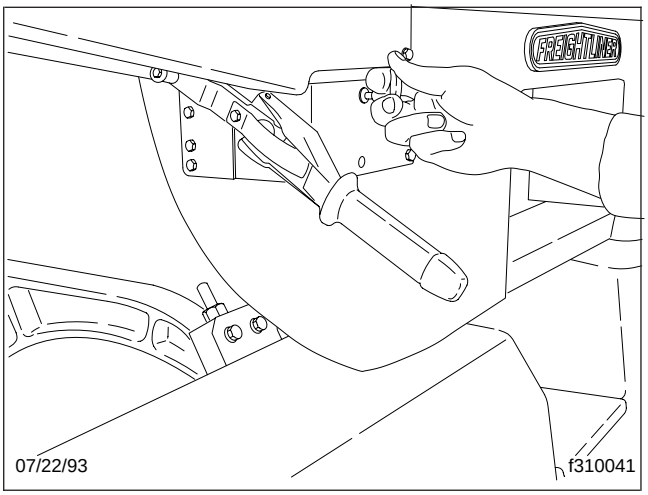


Fig. 9, Safety Hook Release Handle

⚠ CAUTION

Continued application of force to tilt the cab when the shift tube latch mechanism has not released could result in transmission or shift tube damage.

NOTE: If air is present in the hydraulic tilt system, pump operation will seem "spongy" or ineffective. If this happens, bleed the air from the system; for instructions, see **Group 60** of the *Heavy-Duty Trucks Service Manual*.

If the cab stops moving while it is being raised, do not force it to move with the tilt pump. The velocity fuses have locked up the tilt cylinders; unlock them.

7. After the safety hook has been raised above the safety catch (**Fig. 10**), let go of the release handle. Tilt the cab to a 30-degree angle.

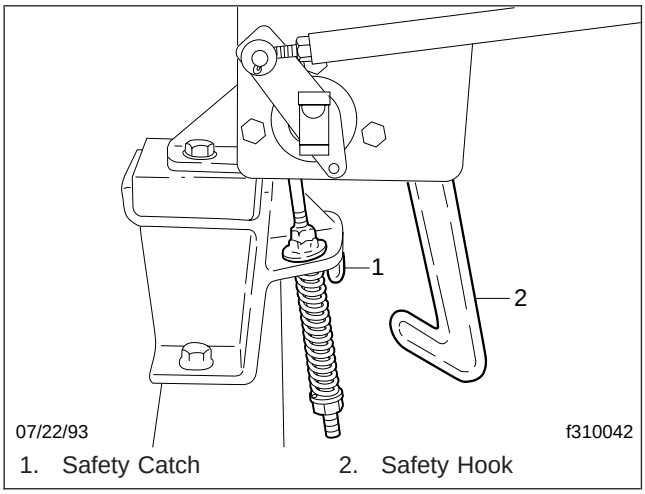


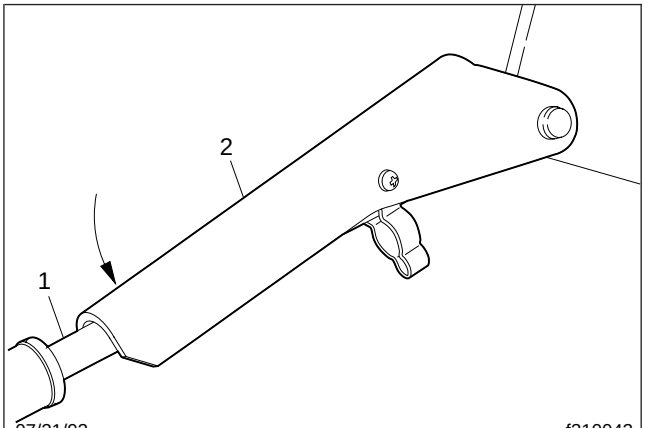
Fig. 10, Safety Catch Mechanism

⚠ WARNING

Make sure the tilt strut is pushed down onto the right tilt-cylinder rod. If the tilt strut is not engaged, and the cab drops, the result could be serious injury or death.

8. When the cab reaches a 30-degree angle, push the free end of the tilt strut down onto the right tilt-cylinder rod. See **Fig. 11**. The tilt strut prevents the cab from accidently dropping below this position.
9. To tilt the cab all the way, continue working the pump until the cab nears a 45-degree angle. Reduce pumping speed. Once the cab goes beyond 45 degrees, stop pumping. The cab will gently descend to a full-tilt position. To stop the cab at any position between 45-degrees and full-tilt, move the control lever to "Lower."

IMPORTANT: If the cab unintentionally stops after it has gone beyond 45 degrees, do not



1. Tilt-Cylinder Rod
2. Tilt Strut

Fig. 11, Tilt Strut Positioning

force it down with the tilt pump. The velocity fuses have locked the tilt cylinders; unlock them.

Returning the FLA Cab from the Tilted Position

DANGER

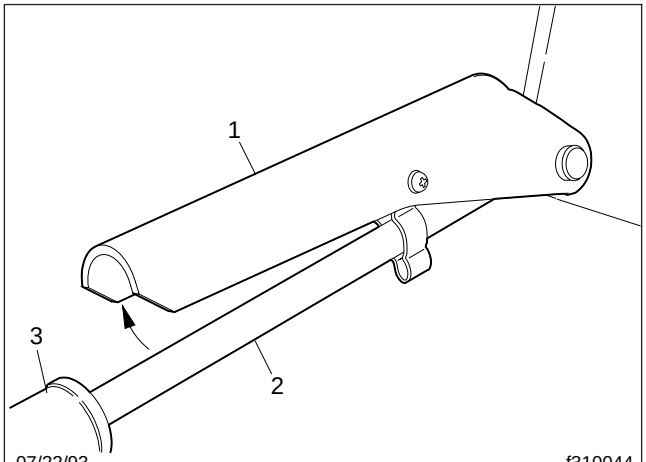
Stay completely clear of the cab's travel path at all times. Once the tilt strut has been released, do not lean over the frame rails, the engine, or the transmission for any reason. To do so could result in serious injury or death.

1. Move the tilt strut away from the right tilt-cylinder rod, and lock it in the spring catch.

   If the cab was tilted less than 45 degrees, raise it enough to release the tilt strut. Move the tilt strut away from the tilt-cylinder rod, and lock it in the spring catch before lowering the cab. See **Fig. 12**.

2. Set the pump control lever at "Lower," and work the pump until the cab nears a 45-degree angle. Reduce pumping speed. Once the cab goes over center, stop pumping. The cab will gently descend to the operating position.

   To stop the cab at any position between 45 degrees and 30 degrees, move the control lever to "Raise," and push the tilt strut down onto the right tilt-cylinder rod.



1. Tilt Strut
2. Tilt-Cylinder Rod
3. Tilt Cylinder

Fig. 12, Releasing the Tilt Strut

IMPORTANT: If the cab unintentionally stops after it has gone beyond 45 degrees, do not force it down with the tilt pump. The tilt strut is in the locked position, or the velocity fuses have locked the tilt cylinders. Release the tilt strut, or unlock the velocity fuses.

3. When the cab is lowered all the way, make sure the pump control lever is set at "Lower."
4. Lock the cab latch handles. See **Fig. 7**. Make sure the cab latch hooks have engaged the U-bolts on the cab mounts, and that each latch handle lockpin is engaged.
5. Remove the pump handle from the pump shank. Mount the handle in the baggage compartment.
6. Push the transmission shift lever forward to lock the shift tube latch mechanism.

NOTE: Maintain the hydraulic fluid level at the oil fill plug. Add fluid only when the cab is in the operating position. Use only Freightliner-approved hydraulic fluid; see **Group 60** for specified fluid.

General Information

Federal Law, Part 205: Transportation Equipment Noise Emission Controls

Part 205, Transportation Equipment Noise Emission Controls, requires the vehicle manufacturer to furnish, with each new vehicle, such written instructions for the proper maintenance, use, and repair of the vehicle by the ultimate purchaser to provide reasonable assurance of the elimination or minimization of noise-emission-control degradation throughout the life of the vehicle. In compliance with the law, the noise emission controls maintenance information in each applicable group of this manual, in conjunction with the vehicle service manual, provides these instructions to owners.

Recommendations for Replacement Parts

Replacement parts used for maintenance or repair of noise emission controls should be genuine Freightliner parts. If other than genuine Freightliner parts are used for replacement or repair of components affecting noise emission control, the owner should be sure that such parts are warranted by their manufacturer to be equivalent to genuine Freightliner parts in performance and durability.

Freightliner Noise Emission Controls Warranty

Refer to the vehicle owner's warranty information book for warranty information concerning noise emission controls.

Tampering with Noise Controls is Prohibited

Federal law prohibits the following acts or the causing thereof:

1. The removal or rendering inoperative by any person (other than for purposes of maintenance, repair, or replacement) of any device or element of design incorporated into any new vehicle for the purpose of noise control, prior to its sale or delivery to the ultimate purchaser, or while it is in use.
2. The use of the vehicle after such device or element of design has been removed or rendered inoperative by any person.

   Among those acts presumed to constitute tampering are the acts listed below:

   A. Removal of engine noise-deadening panels.

   B. Removal of cab-tunnel or hood noise-deadening panels.

   C. Removal of, or rendering inoperative, the engine speed governor so as to allow engine speed to exceed manufacturer's specifications.

   D. Removal of, or rendering inoperative, the fan clutch, including bypassing the control on any thermostatic fan drive to cause it to operate continuously.

   E. Removal of the fan shroud.

   F. Removal of, or rendering inoperative, exhaust components, including exhaust pipe clamping.

   G. Removal of air intake components.

Maintenance Instructions

Scheduled intervals are in the maintenance tables in this group. A "Verification of Inspections Log (Groups 01, 20, and 49)" follows, and should be filled in each time noise emission controls on the vehicle are maintained or repaired.

Verification of Inspections Log: 00–13

Verification of Inspections Log

Verification of Inspections Log, Group 01

Verification of Inspections Log — Group 01 — Engine Rear Supports and Engine Noise Panels				
Date	**Mileage**	**Item**	**Cost**	**Maintenance Facility**

Verification of Inspections Log, Group 20

Verification of Inspections Log — Group 20 — Fan Drive				
Date	**Mileage**	**Item**	**Cost**	**Maintenance Facility**

Verification of Inspections Log: 00–13

Verification of Inspections Log, Group 49

Verification of Inspections Log — Group 49 — Exhaust System Components				
Date	**Mileage**	**Item**	**Cost**	**Maintenance Facility**

Metric/U.S. Customary Conversion Tables: 00–14

When You Know U.S. Customary	Multiply By	To Get Metric	When You Know Metric	Multiply By	To Get U.S. Customary
Length					
inches (in)	25.4	millimeters (mm)		0.03937	inches (in)
inches (in)	2.54	centimeters (cm)		0.3937	inches (in)
feet (ft)	0.3048	meters (m)		3.281	feet (ft)
yards (yd)	0.9144	meters (m)		1.094	yards (yd)
miles (mi)	1.609	kilometers (km)		0.6215	miles (mi)
Area					
square inches (in^2)	645.16	square millimeters (mm^2)		0.00155	square inches (in^2)
square inches (in^2)	6.452	square centimeters (cm^2)		0.155	square inches (in^2)
square feet (ft^2)	0.0929	square meters (m^2)		10.764	square feet (ft^2)
Volume					
cubic inches (in^3)	16387.0	cubic millimeter (mm^3)		0.000061	cubic inches (in^3)
cubic inches (in^3)	16.387	cubic centimeters (cm^3)		0.06102	cubic inches (in^3)
cubic inches (in^3)	0.01639	liters (L)		61.024	cubic inches (in^3)
fluid ounces (fl oz)	29.54	milliliters (mL)		0.03381	fluid ounces (fl oz)
pints (pt)	0.47318	liters (L)		2.1134	pints (pt)
quarts (qt)	0.94635	liters (L)		1.0567	quarts (qt)
gallons (gal)	3.7854	liters (L)		0.2642	gallons (gal)
cubic feet (ft^3)	28.317	liters (L)		0.03531	cubic feet (ft^3)
cubic feet (ft^3)	0.02832	cubic meters (m^3)		35.315	cubic feet (ft^3)
Weight/Force					
ounces (av) (oz)	28.35	grams (g)		0.03527	ounces (av) (oz)
pounds (av) (lb)	0.454	kilograms (kg)		2.205	pounds (av) (lb)
U.S. tons (t)	907.18	kilograms (kg)		0.001102	U.S. tons (t)
U.S. tons (t)	0.90718	metric tons (t)		1.1023	U.S. tons (t)
Torque/Work Force					
inch–pounds (lbf·in)	11.298	Newton–centimeters (N·cm)		0.08851	inch–pounds (lbf·in)
foot–pounds (lbf·ft)	1.3558	Newton–meters (N·m)		0.7376	foot–pounds (lbf·ft)
Pressure/Vacuum					
inches of mercury (inHg)	3.37685	kilo Pascals (kPa)		0.29613	inches of mercury (inHg)
pounds per square inch (psi)	6.895	kilo Pascals (kPa)		0.14503	pounds per square inch (psi)

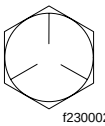
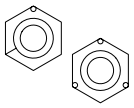
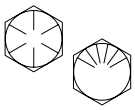
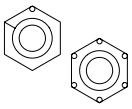
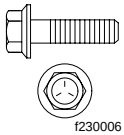
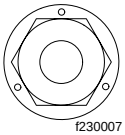
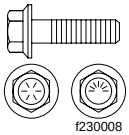
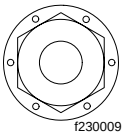
Table 2, Metric/U.S. Customary Conversion

Metric/U.S. Customary Conversion Tables: 00–14

Temperature Conversion							
When You Know	**Subtract**	**Then Divide By**	**To Get**	**When You Know**	**Multiply By**	**Then Add**	**To Get**
degrees Fahrenheit (°F)	32	1.8	degrees Celsius (°C)		1.8	32	degrees Fahrenheit (°F)

Table 3, Temperature Conversion

Torque Specifications Tables: 00–15

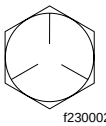
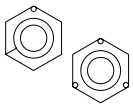
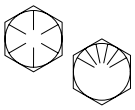
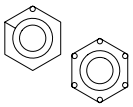
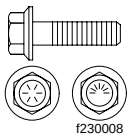
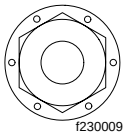
Torque Values for U.S. Customary Thread Fasteners with Lubricated* or Plated Threads†								
Thread Diameter–Pitch	Regular Hex				Flanged			
	Grade 5 Bolt	Grade 5 or B Nut	Grade 8 or 8.2 Bolt	Grade 8 or C Nut	Grade 5 Bolt	Grade B Nut	Grade 8 or 8.2 Bolt	Grade G Nut
	Torque: lbf·ft (N·m)		Torque: lbf·ft (N·m)		Torque: lbf·ft (N·m)		Torque: lbf·ft (N·m)	
	 f230002	 f230003	 f230004	 f230005	 f230006	 f230007	 f230008	 f230009
1/4–20	7 (9)		8 (11)		6 (8)		10 (14)	
1/4–28	8 (11)		9 (12)		7 (9)		12 (16)	
5/16–18	15 (20)		16 (22)		13 (18)		21 (28)	
5/16–24	16 (22)		17 (23)		14 (19)		23 (31)	
3/8–16	26 (35)		28 (38)		23 (31)		37 (50)	
3/8–24	30 (41)		32 (43)		25 (34)		42 (57)	
7/16–14	42 (57)		45 (61)		35 (47)		60 (81)	
7/16–20	47 (64)		50 (68)		40 (54)		66 (89)	
1/2–13	64 (87)		68 (92)		55 (75)		91 (123)	
1/2–20	72 (98)		77 (104)		65 (88)		102 (138)	
9/16–12	92 (125)		98 (133)		80 (108)		130 (176)	
9/16–18	103 (140)		110 (149)		90 (122)		146 (198)	
5/8–11	128 (173)		136 (184)		110 (149)		180 (244)	
5/8–18	145 (197)		154 (209)		130 (176)		204 (277)	
3/4–10	226 (306)		241 (327)		200 (271)		320 (434)	
3/4–16	253 (343)		269 (365)		220 (298)		357 (484)	
7/8–9	365 (495)		388 (526)		320 (434)		515 (698)	
7/8–14	402 (545)		427 (579)		350 (475)		568 (770)	
1–8	—		582 (789)		—		—	
1–12	—		637 (863)		—		—	
1–14	—		652 (884)		—		—	

* Freightliner recommends that all plated and unplated fasteners be coated with oil before installation.

† Use these torque values if either the bolt or nut is lubricated or plated (zinc-phosphate conversion-coated, cadmium-plated, or waxed).

Table 4, Torque Values for U.S. Customary Thread Fasteners with Lubricated or Plated Threads

Torque Specifications Tables: 00–15

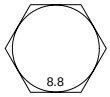
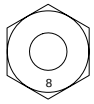
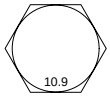
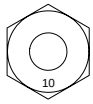
Torque Values for U.S. Customary Thread Fasteners with Dry (Unlubricated)* Plain (Unplated) Threads†						
Thread Diameter–Pitch	Regular Hex				Flanged	
	Grade 5 Bolt	Grade 5 or B Nut	Grade 8 or 8.2 Bolt	Grade 8 or C Nut	Grade 8 or 8.2 Bolt	Grade G Nut
	Torque: lbf·ft (N·m)		Torque: lbf·ft (N·m)		Torque: lbf·ft (N·m)	
	 f230002	 f230003	 f230004	 f230005	 f230008	 f230009
1/4–20	8 (11)		10 (14)		—	
1/4–28	9 (12)		12 (16)		—	
5/16–18	15 (20)		22 (30)		22 (30)	
5/16–24	17 (23)		25 (34)		—	
3/8–16	28 (38)		40 (54)		40 (54)	
3/8–24	31 (42)		45 (61)		—	
7/16–14	45 (61)		65 (88)		65 (88)	
7/16–20	50 (68)		70 (95)		—	
1/2–13	70 (95)		95 (129)		95 (129)	
1/2–20	75 (102)		110 (149)		—	
9/16–12	100 (136)		140 (190)		140 (190)	
9/16–18	110 (149)		155 (210)		—	
5/8–11	135 (183)		190 (258)		190 (258)	
5/8–18	155 (210)		215 (292)		—	
3/4–10	240 (325)		340 (461)		340 (461)	
3/4–16	270 (366)		380 (515)		—	
7/8–9	385 (522)		540 (732)		—	
7/8–14	425 (576)		600 (813)		—	
1–8	580 (786)		820 (1112)		—	
1–12	635 (861)		900 (1220)		—	
1–14	650 (881)		915 (1241)		—	

* Threads may have residual oil, but will be dry to the touch.

† Male and female threads (bolt and nut) must both be unlubricated and unplated; if either is plated or lubricated, use **Table 4**. Freightliner recommends that all plated and unplated fasteners be coated with oil before installation.

Table 5, Torque Values for U.S. Customary Thread Fasteners with Dry (Unlubricated) Plain (Unplated) Threads

Torque Specifications Tables: 00–15

Torque Values for Metric Thread Fasteners with Lubricated* or Plated Threads†				
Thread Diameter–Pitch	Class 8.8 Bolt	Class 8 Nut	Class 10.9 Bolt	Class 10 Nut
	Torque: lbf·ft (N·m)		Torque: lbf·ft (N·m)	
	 f230010	 f230011	 f230012	 f230013
M6	5 (7)		7 (9)	
M8	12 (16)		17 (23)	
M8 x 1	13 (18)		18 (24)	
M10	24 (33)		34 (46)	
M10 x 1.25	27 (37)		38 (52)	
M12	42 (57)		60 (81)	
M12 x 1.5	43 (58)		62 (84)	
M14	66 (89)		95 (129)	
M14 x 1.5	72 (98)		103 (140)	
M16	103 (140)		148 (201)	
M16 x 1.5	110 (149)		157 (213)	
M18	147 (199)		203 (275)	
M18 x 1.5	165 (224)		229 (310)	
M20	208 (282)		288 (390)	
M20 x 1.5	213 (313)		320 (434)	
M22	283 (384)		392 (531)	
M22 x 1.5	315 (427)		431 (584)	
M24	360 (488)		498 (675)	
M24 x 2	392 (531)		542 (735)	
M27	527 (715)		729 (988)	
M27 x 2	569 (771)		788 (1068)	
M30	715 (969)		990 (1342)	
M30 x 2	792 (1074)		1096 (1486)	

* Freightliner recommends that all plated and unplated fasteners be coated with oil before installation.

† Use these torque values if either the bolt or nut is lubricated or plated (zinc-phosphate conversion-coated, cadmium-plated, or waxed).

Table 6, Torque Values for Metric Thread Fasteners with Lubricated or Plated Threads

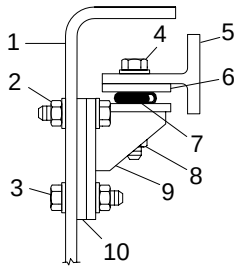
Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Engine Drive Belt Inspecting	01–04
Engine Noise Panel Inspecting (Noise Emission Control)	01–02
Engine Rear-Support Assembly Checking (Noise Emission Control)	01–01
Jacobs Engine Brake Wiring Inspecting	01–03

01–01 Engine Rear-Support Assembly Checking (Noise Emission Control)

Front and rear engine supports for vehicles built from January 2007 require no periodic maintenance. Mounts should be inspected when the engine is removed for service. For vehicles manufactured prior to January 2007, perform the following check.

Visually inspect the rubber isolators (see **Fig. 1**, Ref. 7 for an FLA, FLB, or FLD; **Fig. 2**, Refs. 4 and 6 for an FLC) for cracks, cuts, and other damage; replace if damaged. Also, at engine overhaul or whenever the engine has been removed, replace the isolators. See **Group 01** of the *Heavy-Duty Trucks Service Manual* for isolator replacement procedures.



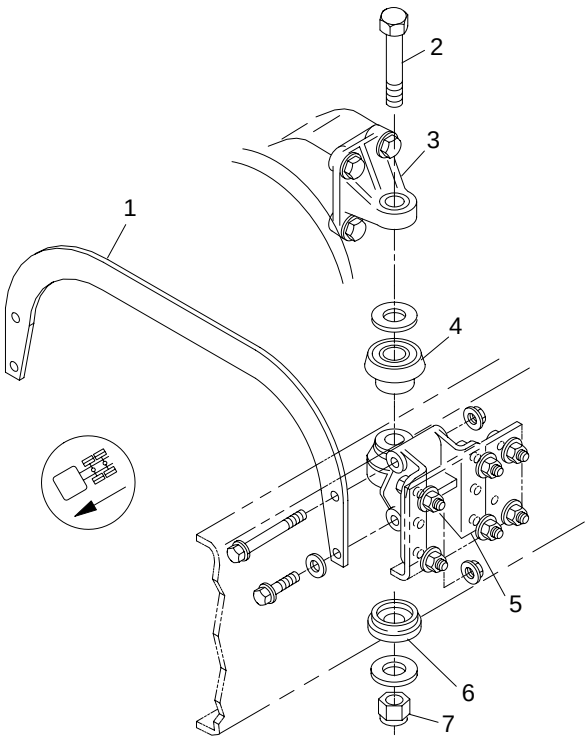
05/27/93 f010155a

1. Frame Rail
2. Upper Mounting Bolt, Nut, and Washers
3. Lower Mounting Bolt, Nut, and Washers
4. Engine Rear Support Bolt and Washer
5. Engine Leg
6. Snubbing Washers or Wear Plate(s)
7. Rubber Isolator
8. Locknut, Washer, and Snubbing Washer
9. Engine Mount
10. Spacer(s)

Fig. 1, Engine Rear-Support Assembly, FLA, FLB, and FLD

Check the engine rear-support fasteners for tightness. See **Fig. 1** for an FLA, FLB, or FLD, or **Fig. 2** for an FLC.

See **Table 1** for torque specifications.



01/16/96 f010648

1. Overslung Crossmember
2. Engine-Support Bolt
3. Transmission-Mounted Engine-Support Bracket
4. Upper Isolator
5. Frame-Mounted Engine-Support Bracket
6. Lower Isolator
7. Engine-Support Stop Nut

Fig. 2, Engine Rear-Support Assembly, FLC

Rear Engine-Support Fasteners Torque Specifications			
Description	**Size**	**Grade**	**Torque*: lbf·ft (N·m)**
Rear Engine-Support-Isolator Nut, FLA, FLB, and FLD	5/8–11	C	160 (216)
Rear Engine-Support-Isolator Stop Nut, FLC	1.00–8	B	280–380 (380–515)
Frame-Mounted Engine-Support-Bracket Nut	5/8–11	C	190 (258)
Transmission-Mounted Engine-Support-Bracket Capscrew, FLC	3/4–10	8	340 (461)
Overslung Crossmember Nut, FLC	1/2–13	C	95 (129)

* Torque values are for dry, unplated fasteners.

Table 1, Rear Engine-Support Fasteners Torque Specifications

01–02 Engine Noise Panel Inspecting (Noise Emission Control)

If so equipped, inspect for torn engine noise panels. See **Fig. 3** for a Caterpillar engine, or see **Fig. 4** for a Cummins engine. If panels are torn, replace them with new panels; see **Group 01** of the *Heavy-Duty Trucks Service Manual* for procedures. Cummins M11 and N14 engines, and Detroit Diesel Series 55 and Series 60 engines do not have engine noise panels.

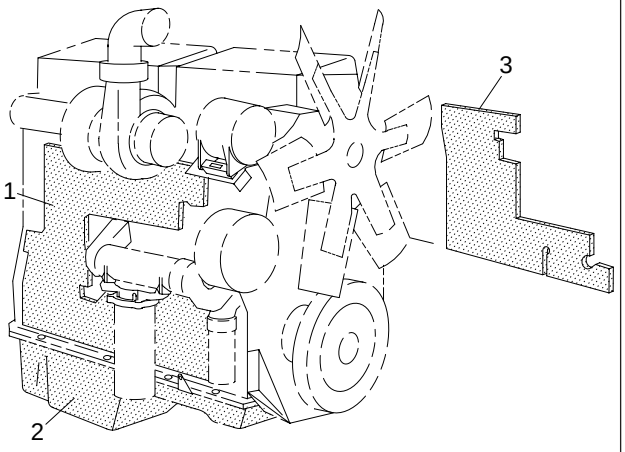
01–03 Jacobs Engine Brake Wiring Inspecting

Inspect the wiring from the dash switches to the engine brake housings for breaks and for broken or chafed insulation. Make sure that all terminal connections are in good condition and are fastened. Inspect the wiring to the clutch and throttle switches. See **Group 01** of the *Heavy-Duty Trucks Service Manual* for the engine brake wiring diagram.

NOTE: Some engine brake installations do not use clutch or throttle switches.

01–04 Engine Drive Belt Inspecting

Worn or loose drive belts may cause premature bearing failure or engine overheating. Excessive tension, or too little tension on the belt may result in excessive and premature belt wear. Poly-V belts, or

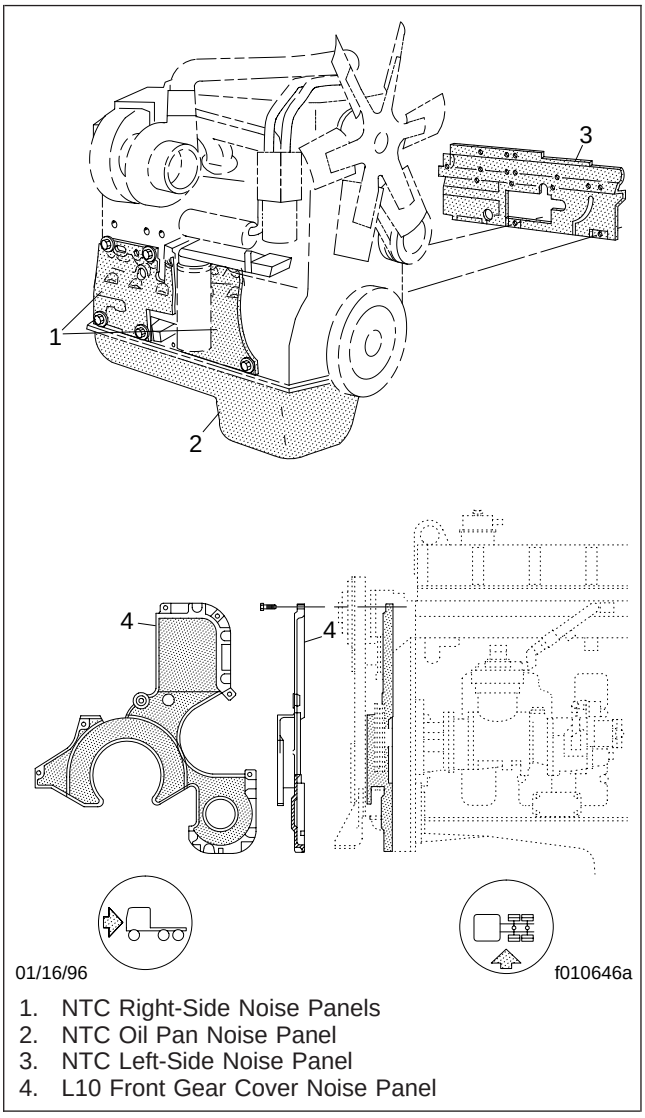


NOTE: Caterpillar 3406E engines do not have right-side noise panels.

1. Right-Side Noise Panel
2. Oil Pan Noise Panel
3. Left-Side Noise Panel

Fig. 3, Caterpillar Engine Noise Panels

serpentine belts are retained by a belt tensioner that requires no tension adjustment. Replace the engine drive belt if any conditions described in the visual description are found. V-belts are installed as individual belts, and as matched sets. When replacing a matched set of belts, always replace both belts at the same time. Matched belts must be from the same manufacturer. To inspect a belt, gently twist the belt to view the belt sidewalls and bottom. Visually inspect all drive belts for the following conditions, then perform the belt tension inspection:



1. NTC Right-Side Noise Panels
2. NTC Oil Pan Noise Panel
3. NTC Left-Side Noise Panel
4. L10 Front Gear Cover Noise Panel

Fig. 4, Cummins Engine Noise Panels

Visual Inspection

1. Inspect the belt for glazing. See **Fig. 5**, Ref. A. Glazing is represented by shiny sidewalls, and is caused by friction created when a loose belt slips in the pulleys. It can also be caused by oil or grease contamination on the pulleys.
2. Check the belt for ply separation. See **Fig. 5**, Ref. B. Oil, grease, or belt dressing can cause the belt to fall apart in layers. Repair any oil or coolant leaks that are affecting the belts before replacing the drive belts. Do not use belt dressing on any belt.
3. Check the belt for a jagged or streaked sidewall. See **Fig. 5**, Ref. C. Jagged or streaked sidewalls are the result of foreign objects, such as sand or gravel in the pulley, or a rough pulley surface.
4. Check for tensile breaks; breaks in the cord body. See **Fig. 5**, Ref. D. Cuts in a belt are usually caused by foreign objects in the pulley, or by prying or forcing the belt during removal or installation.
5. Check for uneven ribs on serpentine (poly-V) belts. See **Fig. 5**, Ref. E. Foreign objects in the pulley will erode the undercord ribs, causing the belt to lose its gripping power.
6. Check the drive belts for cracks. See **Fig. 5**, Ref. F. Small irregular cracks are usually the signs of an old belt.
7. Visually inspect the pulleys for excessive play or wobble. Excessive play or wobble indicates a failure of the pulley bearing. Check for belt squealing or squeaking. Replace the bearings as necessary.

NOTE: If it is difficult to distinguish the location of a supposed bearing noise, place a stethoscope on the component being checked, not the pulley, to isolate the area from outside interference.

8. Inspect all pulleys for foreign objects, oil, or grease in the grooves.

Belt Tension Inspection

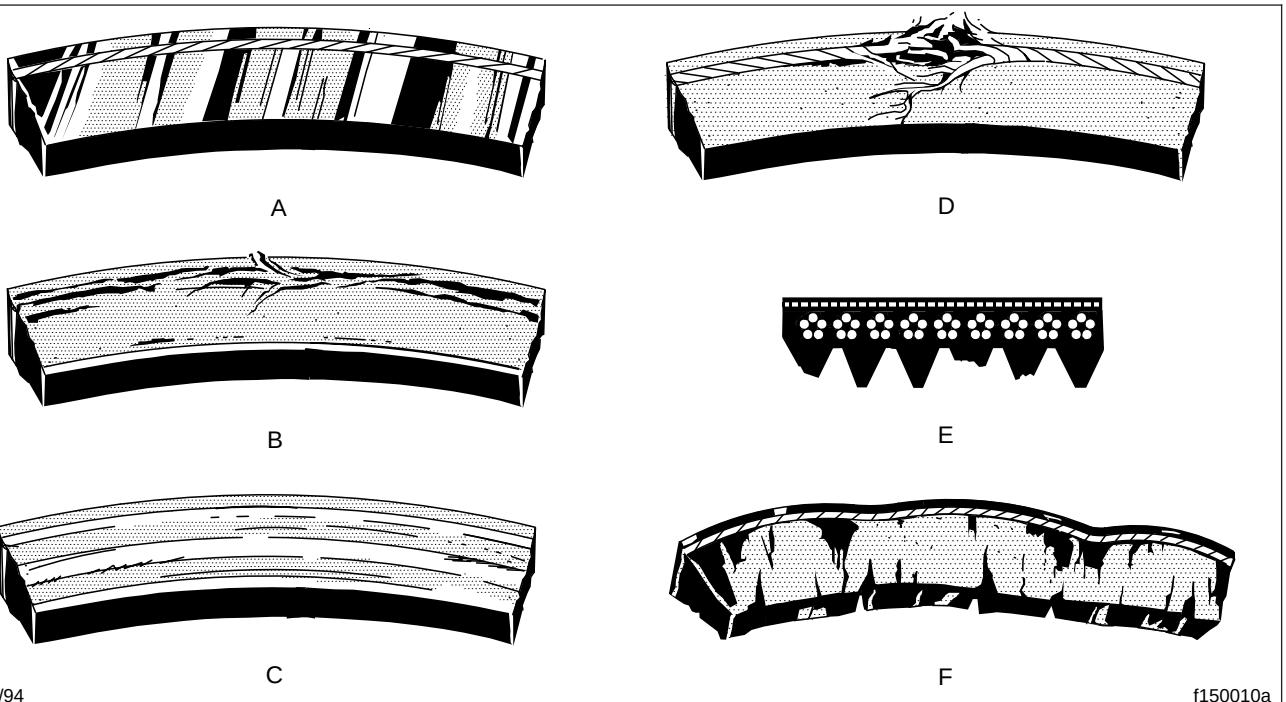
NOTE: If engine drive belts require adjustment, see **Group 01** of the *Heavy-Duty Trucks Service Manual*.

Threaded-Adjustment Type

1. Apply the parking brakes, and chock the tires to prevent the vehicle from moving.
2. Install a belt tension gauge at the center of the belt's longest free-span. Check belt tension. See **Table 2** for belt tension specifications.
3. If belt tension is not correct, see **Group 01** of the *Heavy-Duty Trucks Service Manual* to adjust belt tension.

Spring-Tension Type

On belts equipped with a spring tensioner, the belt tension is automatically adjusted. Check that the tensioner is holding tension on the belt by inserting the end of a breaker bar in the 1/2-inch square hole on the forward face of the tensioner, and rotating the tensioner down, away from the belt. When the breaker bar is slowly released, the tensioner should return to its original position. If not, see **Group 01** of the *Heavy-Duty Trucks Service Manual* for replacement instructions.



A. Glazing
B. Separating Layers
C. Streaked Sidewalls
D. Tensile Break
E. Uneven Ribs
F. Cracks

Fig. 5, Drive Belt Replacement Conditions

Drive Belt Tensions		
Engine	**Component**	**Belt Tension: lbf (kg)**
Caterpillar C10 (3176)	Refrigerant Compressor	80 to 100 (36 to 45)
Caterpillar 3406E	Alternator and Refrigerant Compressor	40 to 50 (18 to 23), per belt
	Fan	80 to 100 (36 to 45)

Drive Belt Tensions		
Engine	**Component**	**Belt Tension: lbf (kg)**
Cummins M11	Alternator	90 to 120 (41 to 55)
	Fan	155 to 165 (70 to 75)
	Refrigerant Compressor	80 to 100 (36 to 45)
Cummins N14	Alternator	40 to 50 (18 to 23), per belt
	Fan	80 to 120 (36 to 54)
	Refrigerant Compressor	80 to 100 (36 to 45)
Detroit Diesel Series 60	Alternator and Refrigerant Compressor	80 to 100 (36 to 45), power band
	Fan	60 to 80 (27 to 36)

Table 2, Drive Belt Tensions

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Air Cleaner Element Inspecting and Replacing	09–01

09–01 Air Cleaner Element Inspecting and Replacing

Method 1

Replace the air cleaner element at the recommended interval or when the air restriction indicator reaches 20 inH_2O on a vehicle with a Detroit Diesel engine, 22 inH_2O on a vehicle with a Mercedes-Benz engine, or 25 inH_2O on a vehicle with a Caterpillar or Cummins engine. For replacement instructions, see **Group 09** of the *Heavy-Duty Trucks Service Manual*. Reset the air restriction indicator.

If the maximum restriction is not reached, record the air restriction value. If the value is higher than the previous recording, reset the air restriction indicator. If the value is lower than the previous recording, inspect the air cleaner and air cleaner element of cracks, leaks, or any other damage.

If the air cleaner or air cleaner element is damaged, replace it and reset the air restriction indicator.

Method 2

Replace the air cleaner element at the recommended interval or when the air restriction indicator reaches 20 inH_2O on a vehicle with a Detroit Diesel engine, 22 inH_2O on a vehicle with a Mercedes-Benz engine, or 25 inH_2O on a vehicle with a Caterpillar or Cummins engine. For replacement instructions, see **Group 09** of the *Heavy-Duty Trucks Service Manual*. Reset the air restriction indicator.

If the maximum restriction is not reached, inspect the air cleaner and air cleaner element for cracks, leaks, or any other damage. If the air cleaner or air cleaner element is damaged, replace it and reset the air restriction indicator.

Index, Alphabetical

Title of Maintenance Operation (MOP) **MOP Number**

Bendix Air Compressor Inspecting. 13–01

13–01 Bendix Air Compressor Inspecting

Inspect the air intake line, oil supply and return lines, and coolant supply and return hoses, for tight connections and general condition. Tighten the connections, and replace the lines and hoses, as needed. If the compressor air-intake adapter is loose, remove the adapter, replace the adapter gaskets, and securely install the adapter.

Check the cooling fins on the compressor crankcase. Clean the fins if they are clogged with dirt or grease.

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Alternator, Battery, and Starter Checking	15–01

15–01 Alternator, Battery, and Starter Checking

⚠ WARNING

Batteries generate explosive gas as a by-product of their chemical process. Do not smoke when working around batteries. Put out all flames and remove any source of sparks or intense heat in the vicinity of the battery compartment. Make sure the battery compartment has been completely vented before disconnecting or connecting the battery cables.

Battery acid is extremely harmful if splashed in the eyes or on the skin. Always wear a face shield and protective clothing when working around batteries.

1. Check the tightness of the alternator bracket fasteners; tighten the fasteners as needed. For torque values, see **Group 15** of the *Heavy-Duty Trucks Service Manual*.
2. Check the belt tension of the alternator drive belt. Use a tension gauge at the belt's widest span, and adjust the belt tension if needed. See **Group 01** for belt tension specifications. Some engines are equipped with dual alternator belts; check both belts for correct tension. Engines equipped with a serpentine or poly-V belt have automatic belt tensioners and do not require belt tension inspection.
3. Clean and tighten all charging system electrical connections, including the connections at the starter B terminal and ground terminal, and at the terminators of the alternator charging cable.
4. On the bundled cable that runs from the batteries to the starter, ensure that tie-straps are installed at least every 12 inches (300 mm). Replace any missing tie-straps and add tie-straps where spacing between straps exceeds 12 inches (300 mm).
5. Ensure that all cables have sufficient slack to allow for engine movement, and that there is no pressure on any wiring connectors.
6. Check all wiring inside of damaged convoluted tubing and replace any damaged or missing convoluted tubing.
7. Inspect the battery cables for wear, and replace as needed. Clean the cable connector terminals with a wire brush. See **Group 54** of the *Heavy-Duty Trucks Service Manual* for troubleshooting, adjustment, repair, or replacement instructions.
   - 7.1 Clean and tighten the battery ground cable, terminal, and clamps.
   - 7.2 Inspect the retainer assembly (or battery hold-downs) and the battery box. Replace worn or damaged parts. Remove any corrosion with a wire brush, and wash with a weak solution of baking soda and water. Rinse with clean water, and dry. Paint the retainer assembly, if needed to prevent rusting.
   - 7.3 Check that there are no foreign objects, such as stones, bolts, and nuts in the battery box.
   - 7.4 After cleaning, connect the cables to the batteries, and tighten them to the torque specifications listed on the battery, generally 10 to 15 lbf·ft (14 to 20 N·m).
   - 7.5 Coat the battery terminals with dielectric grease.
8. Check the alternator wiring for missing insulation, kinks, and heat damage. Replace or repair as needed.
9. Check the terminals on the battery shut-off switch and the magnetic switch. Make sure the terminal connections are clean and tight. Coat the terminal connections with dielectric red enamel after cleaning.

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Fan Drive and Clutch Checking (Noise Emission Control)	20–03
Radiator Cap Checking	20–01
Radiator Pressure Flushing and Coolant Changing	20–02

20–01 Radiator Cap Checking

⚠ WARNING

Do not remove or loosen the radiator cap until the engine and cooling system have completely cooled. Use extreme care when removing the cap. A sudden release of pressure from removing the cap prior to the system cooling can result in a surge of scalding coolant that could cause serious personal injury.

⚠ CAUTION

The radiator cap currently installed may not be the same one installed when the vehicle was built. If the radiator cap must be replaced, make sure that it is the correct cap for the cooling system of the vehicle. Because the radiator cap pressure rating affects the operating temperature of the engine, installing an improperly rated radiator cap may have adverse effects on the cooling system, and engine operating temperatures. This could cause premature engine wear or damage.

1. Using a radiator-cap tester, check the pressure cap to see if it maintains pressure to within 10 percent of the pressure rating marked on the cap. If it doesn't, replace the cap. Make sure that the replacement radiator cap is correctly rated for the cooling system of the vehicle.
2. There is a second valve in the radiator cap that opens under vacuum. This prevents the collapse of hoses and other parts that are not internally supported when the system cools. Inspect the vacuum-relief valve to be sure it is not stuck.
3. Make sure that the cap seals properly on the coolant filler neck seat, and that the radiator cap gasket is not damaged. On vehicles with screw on caps with O-rings, make sure that the O-ring is not cracked or deteriorated. Replace the cap if the gasket shows deterioration or damage.

20–02 Radiator Pressure Flushing and Coolant Changing

NOTE: For additional instructions on cleaning and flushing the cooling system, see the applicable engine manufacturer's maintenance and operation manual.

1. If necessary, remove the aerodynamic cover from the front bumper.
2. Drain the radiator as follows:

   For a low-flow cooling system, disconnect the radiator bottom tank inlet and outlet hoses, and tighten the radiator cap. Attach the flushing gun nozzle to the outlet hose.

   For a high-flow cooling system, disconnect the radiator upper and lower hoses, and tighten the radiator cap. Attach the flushing gun nozzle to the lower hose.
3. Run the water until the radiator is full.

⚠ CAUTION

Excessive pressure can damage the radiator or heater core.

4. Gradually, apply air pressure to help dislodge sediment built up in the radiator core. Do not apply more than 15 psi (103 kPa) air pressure to the radiator. Pressures exceeding 15 psi (103 kPa) could damage the radiator core.
5. Shut off the air at the pressure gun nozzle and allow the radiator to refill with water.
6. Repeat the previous two steps until clean water flows from the radiator.
7. Remove the radiator side tank drain plug and allow the radiator to drain. Install and tighten the side tank drain plug and the radiator outlet pipe drain plug after the radiator has been drained. Do not overtighten the plugs.
8. Connect the hoses. Your hose clamps can be either T-bolt clamps (see **Fig. 1**) or Breeze Constant-Torque clamps (see **Fig. 2**).

   When working with T-bolt hose clamps, tighten the clamps 55 lbf·in (620 N·cm). These clamps are now standard on hoses with an inside diameter greater than 2 inches (51 mm).

   When installing Breeze Constant-Torque hose clamps, the clamps must be tightened to the correct torque. The screw tip of the clamp must extend about 1/4 inch (6 mm) from the clamp housing, and the belleville washer stacks must be collapsed almost flat. Use a torque wrench to

install these clamps correctly. Correct installation torque for Breeze Constant-Torque hose clamps is:

For clamps with a 5/16-inch tightening screw hex: 55 lbf·in (620 N·cm).

For clamps with a 3/8-inch tightening screw hex: 90 lbf·in (1020 N·cm).

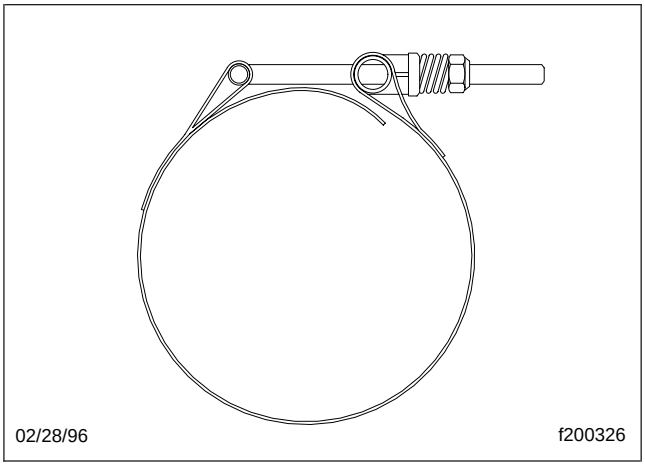
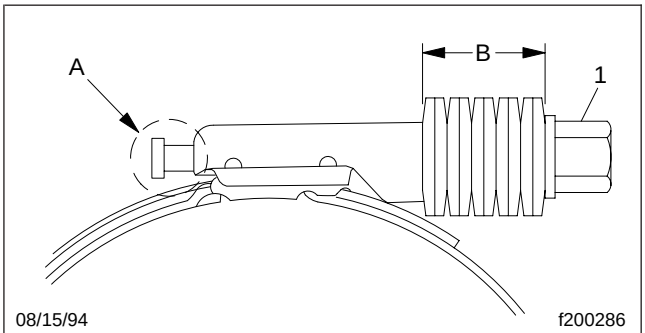


Fig. 1, T-Bolt Type Hose Clamp



A. The screw tip must extend about 1/4 inch (6 mm).
B. The belleville washer stacks must be collapsed almost flat.
1. Tightening Screw Hex

Fig. 2, Breeze Constant-Torque Hose Clamp Installation

NOTE: All hose clamps will lose torque after installation due to "compression set." However, when correctly installed, Breeze Constant-Torque clamps will hold enough torque to automatically adjust and keep consistent sealing pressure. During vehicle operation and shutdown, the screw tip may adjust according to temperature and pressure changes. The torque may need to be adjusted for individual applications.

IMPORTANT: On vehicles with EPA07 compliant engines, the coolant capacity varies depending on the engine and accessory installation. After servicing the cooling system, always verify that the coolant level is between the MIN and MAX lines on the surge tank.

9. Fill the radiator with new coolant. See **Group 20** of the *Heavy-Duty Trucks Service Manual* for guidelines. See **Table 1** for FLA, FLB, and FLD 120 cooling system capacities, **Table 2** for FLC 112 cooling system capacities, **Table 3** for FLD 112 cooling system capacities. See **Table 4** for antifreeze protection information. Certain equipment such as fuel heaters, water filters and auxiliary heaters may increase the coolant capacity and require additional coolant. The cooling system is filled when the coolant level reaches the MAX line on the surge tank. Freightliner recommends the use of a precharged and premixed antifreeze when refilling the cooling system. See **Table 4** for a list of some of the precharged antifreeze available. Use of an equivalent antifreeze to those listed in the table is also acceptable. Always check that the antifreeze used meets Freightliner's specifications and is at the proper concentration for protection in the vehicle operating area. See **Table 5** for antifreeze protection information. Freightliner specifies that the antifreeze must be an ethylene glycol solution that meets GM 6038 M Engineering Standards or a ethylene glycol solution that has less than 0.1% anhydrous sodium metasilicate, and meets either GM 1825 M or GM 1899 M Engineering Standards. If supplemental coolant additives are being used, add the supplements to the coolant as necessary. See the coolant additive manufacturer's instructions for the correct amount of additive required. Don't forget to consider the volume of the supplemental coolant additive being added to the system when determining the amount of coolant required to refill the system.

Engine Cooling System Capacity for FLA, FLB, and FLD 120 (pre-EPA07 engines)				
Engine Make	Engine Model	Radiator Core and System Capacity*:		
		2 Row: quarts (liters)	3 Row: quarts (liters)	4 Row: quarts (liters)
Caterpillar	3176	49.0 (46.4)	50.0 (47.3)	NA
	3306 JWAC	51.9 (49.1)	52.9 (50.0)	53.9 (51.0)
	3306 ATAAC	49.5 (46.8)	50.5 (47.8)	51.5 (48.7)
	3406 JWAC	57.2 (54.1)	58.2 (55.1)	59.2 (56.0)
	3406 ATAAC	55.2 (52.2)	56.2 (53.2)	57.2 (54.1)
Cummins	L10	46.6 (44.1)	47.6 (45.0)	48.6 (46.0)
	L10 OA (low flow)	NA	46.0 (43.5)	47.0 (44.5)
	Big Cam III	55.1 (52.1)	56.1 (53.1)	57.1 (54.0)
	Big Cam IV (low flow)	NA	51.1 (48.4)	52.1 (49.3)
Detroit Diesel	Series 60	56.0 (53.0)	57.0 (53.9)	58.0 (54.9)
	Series 55	47.0 (44.4)	48.0 (45.3)	49.0 (46.3)

* System capacity includes all hoses, fittings, and the heater core.

Table 1, Engine Cooling System Capacity for FLA, FLB, and FLD 120 (pre-EPA07 engines)

Engine Cooling System Capacity for FLC 112				
Engine Make	Engine Model	Radiator Core and System Capacity*		
		2 Row: quarts (liters)	3 Row: quarts (liters)	4 Row: quarts (liters)
Caterpillar	3176	49.0 (46.4)	50.0 (47.3)	NA
	3306B	NA	51.0 (48.3)	NA
	3406B	NA	58.0 (54.9)	58.5 (55.4)
Cummins	L10	41.0 (38.8)	41.5 (39.3)	NA
	Big Cam III	NA	56.0 (53.0)	56.5 (53.5)
	Big Cam IV (low flow)	NA	49.5 (46.8)	50.0 (47.3)
Detroit Diesel	Series 60	NA	NA	58.6 (55.5)
	Series 55	47.0 (44.4)	48.0 (45.3)	49.0 (46.3)

* System capacity includes all hoses, fittings, and the heater core.

Table 2, Engine Cooling System Capacity for FLC 112

Engine Cooling System Capacity for FLD 112		
Engine Make	Engine Model	Radiator Core and System Capacity*: quarts (liters)
Caterpillar	3176, 3306 ATAAC	38.0 (36.0)

Engine Cooling System Capacity for FLD 112		
Engine Make	**Engine Model**	**Radiator Core and System Capacity*: quarts (liters)**
Cummins	6CTA8.3	35.0 (33.1)
	L10	33.0 (31.2)

* System capacity includes all hoses, fittings, and the heater core.

Table 3, Engine Cooling System Capacity for FLD 112

Approved Antifreeze		
Manufacturer	**Antifreeze**	**Type**
Caterpillar	Caterpillar Diesel Engine Antifreeze/Coolant	Contains supplement additives. Available as a premixed solution.
Cummins	Fleetguard® Compleat Premix	Premixed solution with supplement additives

Approved Antifreeze		
Manufacturer	**Antifreeze**	**Type**
Detroit Diesel	Detroit Diesel Power Cool	Premixed solution with supplement additives
Old World Industries	Fleet Charge™	With supplement additives

Table 4, Approved Antifreeze

Maximum Coolant Protection in °F (°C) at Various Antifreeze Concentrations											
Cooling System Capacity: gal (L)*	**Ethylene-Glycol Base Antifreeze Required: gallons (liters)**										
	2 (8)	**3 (11)**	**4 (15)**	**5 (19)**	**6 (23)**	**7 (26)**	**8 (30)**	**9 (34)**	**10 (38)**	**11 (42)**	**12 (45)**
10 (38)	16 (–9)	4 (–16)	–12 (–24)	–34 (–37)	–62 (–52)†						
11 (42)	18 (–8)	8 (–13)	–6 (–21)	–23 (–31)	–47 (–44)	–62 (–52)†					
12 (45)	19 (–7)	10 (–12)	0 (–18)	–15 (–26)	–34 (–37)	–57 (–49)					
13 (49)	21 (–6)	13 (–11)	3 (–16)	–9 (–23)	–25 (–31)	–45 (–43)	–62 (–52)†				
14 (53)		15 (–9)	6 (–14)	–5 (–19)	–18 (–28)	–34 (–37)	–54 (–48)				
15 (57)		16 (–9)	8 (–13)	0 (–18)	–12 (–24)	–26 (–32)	–43 (–42)	–62 (–52)†			
16 (61)		17 (–8)	10 (–12)	2 (–17)	–8 (–22)	–19 (–28)	–34 (–37)	–52 (–47)	–62 (–52)†		
17 (64)		18 (–8)	12 (–11)	5 (–15)	–4 (–20)	–14 (–26)	–27 (–33)	–42 (–41)	–58 (–50)		
18 (68)		19 (–7)	14 (–10)	7 (–14)	0 (–18)	–10 (–23)	–21 (–29)	–34 (–37)	–50 (–46)	–62 (–52)†	
19 (72)		20 (–7)	15 (–9)	9 (–13)	2 (–17)	–7 (–22)	–16 (–27)	–28 (–33)	–42 (–41)	–56 (–49)	

Maximum Coolant Protection in °F (°C) at Various Antifreeze Concentrations											
Cooling System Capacity: gal (L)*	Ethylene-Glycol Base Antifreeze Required: gallons (liters)										
	2 (8)	3 (11)	4 (15)	5 (19)	6 (23)	7 (26)	8 (30)	9 (34)	10 (38)	11 (42)	12 (45)
20 (76)			16 (–9)	10 (–12)	4 (–16)	–3 (–19)	–12 (–24)	–22 (–30)	–34 (–37)	–48 (–44)	–62 (–52)†

* For cooling system capacities not shown, the required amount of antifreeze can be calculated, using the following: Ethylene-glycol base antifreeze in a 25% solution protects to 10°F (–12°C), 33% to 0°F (–18°C), 40% to –12°F (–24°C), 50% to –34°F (–37°C), and 60% to –62°F (–52°C).

† 60% ethylene-glycol base antifreeze and 40% water by volume gives maximum coolant protection (–62°F [–52°C]). Exceeding 60% antifreeze diminishes coolant protection; concentrated ethylene-glycol base antifreeze will freeze at approximately 0°F (–18°C).

Table 5, Maximum Coolant Protection in Degrees F (Degrees C) at Various Antifreeze Concentrations

20–03 Fan Drive and Clutch Checking (Noise Emission Control)

Eaton Viscous Fan Clutch

Periodic maintenance is not required because an Eaton viscous fan drive is a sealed unit. However, periodically check it for damage and for correct operation. If the fan drive is inoperative or damaged, replace it with a new one. See **Group 20** of the *Heavy-Duty Trucks Service Manual* for instructions.

Horton Advantage® and HT 55O Fan Clutch

NOTE: If any part of the fan clutch needs to be fixed or replaced, after performing the checks below, see **Group 20** of the *Heavy-Duty Trucks Service Manual*.

1. Inspect all electrical connections and wires. Tighten the connections if loose, and replace wires and connections if damaged.
2. Charge the air system to 120 psi (627 kPa), then proceed as follows:

⚠ WARNING

Do not jumper the thermal switch while the engine is running. This could start the cooling fan, which could result in serious personal injury.

If the vehicle is equipped with Detroit Diesel Optimized Idling®, make sure this feature is not activated. If Optimized Idling were activated, the engine could start up without warning, resulting in serious personal injury.

2.1 *If equipped with an electric thermal switch,* make sure the engine is not running. Put the ignition switch in the ON position (engine shut down). Place a jumper between the thermal switch connectors (located in the engine thermostat housing), while observing the fan clutch. The fan clutch should be seen and heard engaging.

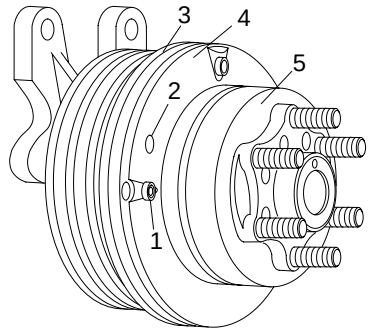
If equipped with a fanstat (shutterstat), run the engine until its temperature is above the fanstat engagement setting of 195°F (91°C). The fan clutch should engage, causing the fan to turn.

⚠ WARNING

Wear safety goggles when draining the air system or loosening an air line, because dirt or sludge could fly out at high speeds. Do not direct the airstream at anyone. Do not disconnect pressurized hoses, since they may whip as air escapes. Failure to take all necessary precautions could result in personal injury.

2.2 If the fan clutch does not engage, see if compressed air is in the fan clutch actuating air line: With the ignition on, but the engine shut down, slowly loosen the fitting that connects the actuating air line to the fan clutch; do not disconnect the fitting. If compressed air escapes, the fan clutch is inoperative and must be repaired. If no compressed air escapes, replace the solenoid valve or fanstat, as applicable. Tighten the fitting.

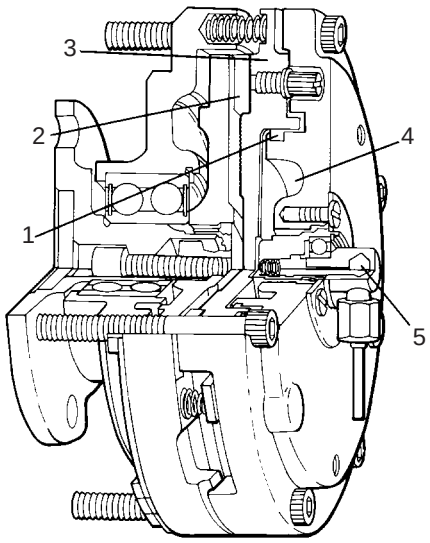
3. Check all air connections for air leaks.
4. Check for wear on the friction facing. See **Fig. 3** (Type S and HT/S) or **Fig. 4** (HT 550). Replace the facing if it is worn to 1/16-inch (1.6-mm) thickness or less on a Type S or HT/S fan clutch, or to 7/32-inch (5.6-mm) on an HT 550 fan clutch.



08/08/94 f200290

1. System Sentry® Fuse
2. Safeguard Hole
3. Friction Facing
4. Piston Friction Disc
5. Air Chamber

Fig. 3, Horton Type S and HT/S Fan Clutch



10/19/93 f500005a

1. O-Ring Seal
2. Friction Facing
3. Piston
4. Air Chamber
5. Rotary Air Union

Fig. 4, Horton HT 550 Fan Clutch

5. If equipped with a toggle switch on the dash, run the engine with the engine temperature below 205°F (96°C) for Caterpillar engines, or below 200°F (93°C) for all other engines. Set the toggle switch to the ON position; the fan clutch should engage. Set the toggle switch to the AUTO or OFF position; the air should exhaust and the fan clutch should disengage. Replace the switch if necessary.
6. With the engine off and the fan clutch engaged, use a listening device to check for air leaks. If a leak is heard, check for air leaks in the fan clutch by lightly brushing a soap solution in the following areas:

   6.1 *Type S and HT/S Fan Clutches* (**Fig. 3**)

   Check for air leaks at the bleed hole on the fan pilot. Air leakage means that the cartridge assembly (**Fig. 5**, Ref. 16) or face seal (Ref. 17) is damaged.

   Check for air leaks between the air chamber and the piston friction disc. Air leakage means that the large O-ring (Ref. 14) is damaged.

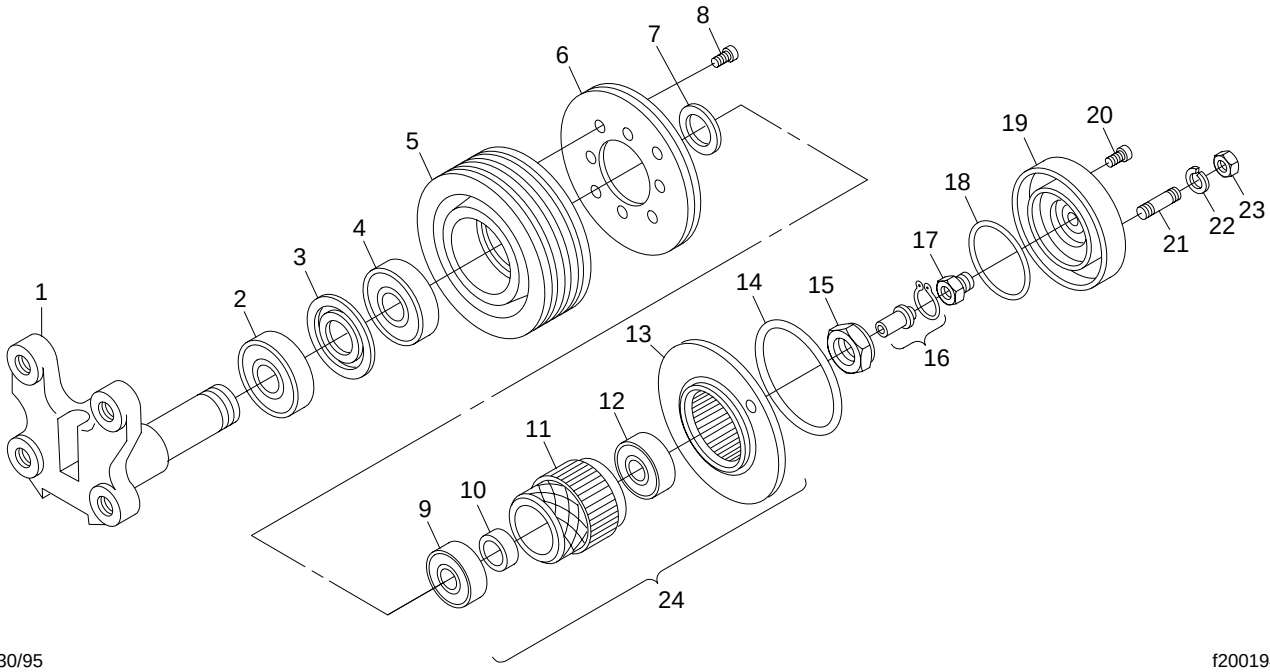
   Check for air leaks around the safeguard hole on the piston friction disc. Air leakage means the small O-ring (Ref. 18) is damaged.

   Check for air leaking from the System Sentry® fuse. Leaking air means the clutch has gotten so hot the lead alloy in the fuse melted. This released the clutch before the heat could damage the clutch bearings. Before replacing the fuse, find and repair the source of the heat.

   6.2 *HT 550 Fan Clutch* (**Fig. 4**)

   Check the rotary air union for air leaks. Make sure the air line at the air union is not restricted due to kinking or bending. If air leakage is found, replace the rotary air union (**Fig. 6**, Ref. 10).

   Check for air leaks around the piston (Ref. 15) and air chamber (Ref. 13). If air leakage is found, replace the O-ring seal (Ref. 11).



1. Mounting Bracket
2. Rear Sheave Bearing
3. Inner and Outer Bearing Spacers
4. Forward Sheave Bearing
5. Sheave
6. Friction Facing
7. Journal Spacer
8. Socket-Head Capscrew
9. Rear Hub Bearing
10. Bearing Spacer
11. Splined Hub
12. Forward Hub Bearing
13. Piston Friction Disc
14. Large O-Ring
15. Locknut
16. Cartridge Assembly
17. Face Seal
18. Small O-Ring
19. Air Chamber
20. Socket-Head Capscrew
21. Stud Bolt
22. Lockwasher
23. Hexnut
24. Piston Assembly

Fig. 5, Horton Type S and HT/S Fan Clutch Components

Kysor/Dynair® and Kysor K22RA Fan Clutch

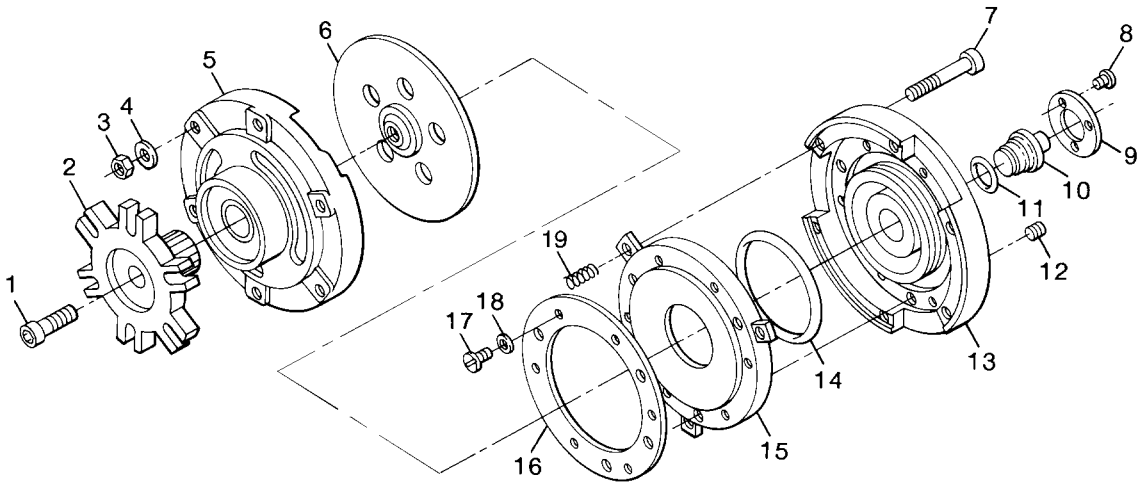
NOTE: *Check the lining wear at the first M3 maintenance interval;* the lining wear does not require checking at the first M2 interval. Subsequent checks must be made at each M2 maintenance interval.

1. Disconnect the electrical cables from the battery. Drain all air from the air system. If equipped with an air starter, drain the air starter reservoir.

⚠ WARNING

If the engine starts during this procedure, the fan could cause personal injury. If the vehicle is equipped with an air starter, be sure that the air starter reservoir is drained.

2. Measure the distance from the back surface of the fan clutch retaining plate to the forwardmost edge of the fan belt pulley. See **Fig. 7**, Ref. *A.*
3. Disconnect the line from the air inlet of the air cylinder. Connect a shop air hose to the inlet.
4. Apply a minimum of 100 psi (690 kPa) air pressure to the air cylinder—the bearing housing will move backwards, disengaging the clutch. Again, measure the distance from the back surface of the retaining plate to the forwardmost edge of the fan belt pulley.
5. Compare the two measurements; if the difference exceeds the wear limit given in **Table 6** for the Kysor/Dynair, or exceeds the wear limit of 0.15



05/27/93 f500006a

1. Capscrew
2. Mounting Bracket
3. Hexnut
4. Washer
5. Drive Sleeve
6. Friction Disc
7. Capscrew
8. Panhead Screw
9. Retaining Washer
10. Rotary Air Union
11. O-Ring Seal
12. Setscrew
13. Air Chamber Assembly
14. O-Ring Seal
15. Piston Assembly
16. Friction Facing
17. Capscrew
18. Washer
19. Compression Spring

Fig. 6, Horton HT 550 Fan Clutch Components

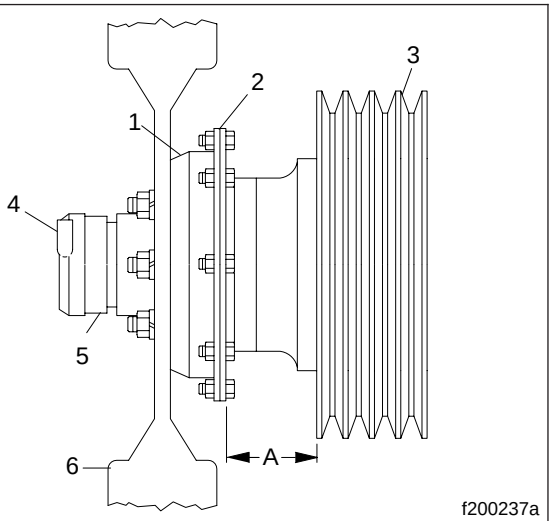
inches (3.8 mm) for the Kysor K22RA, the clutch lining is worn and must be replaced. See **Group 20** of the *Heavy-Duty Trucks Service Manual* for overhaul instructions.

6. Release the air pressure, then disconnect the shop hose from the air inlet of the air cylinder. Connect the vehicle air hose to the inlet.
7. Connect the electrical cables to the battery. If equipped with an air starter, charge the air starter reservoir.
8. Start the engine. The LOW WTR light and warning buzzer should be off. If the light and buzzer are off, the sensor is okay. If the light and buzzer are on, replace the sensor.

Kysor/Dynair Fan Clutch Wear Limits		
Model Numbers*	**Retaining Plate Fasteners***	**Wear Limit: in (mm)**
1090–05261–01 1090–05262–01 1090–05261–02 1090–05262–02	Bolt, Lockwasher, and Nut	0.16 (4.1)
1090–06620–01 1090–06060–01 1090–07050–01 1090–08000–01 1090–06620–02 1090–06060–02 1090–07050–02	Capscrew and Lockwasher	0.17 (4.3)

* The fan clutch model number is stamped on the tag on the air cylinder. Also, the models can be identified by the type of retaining plate fasteners used.

Table 6, Kysor/Dynair Fan Clutch Wear Limits



With the fan clutch engaged, measure the distance at *A*; measure it again with the fan clutch disengaged.

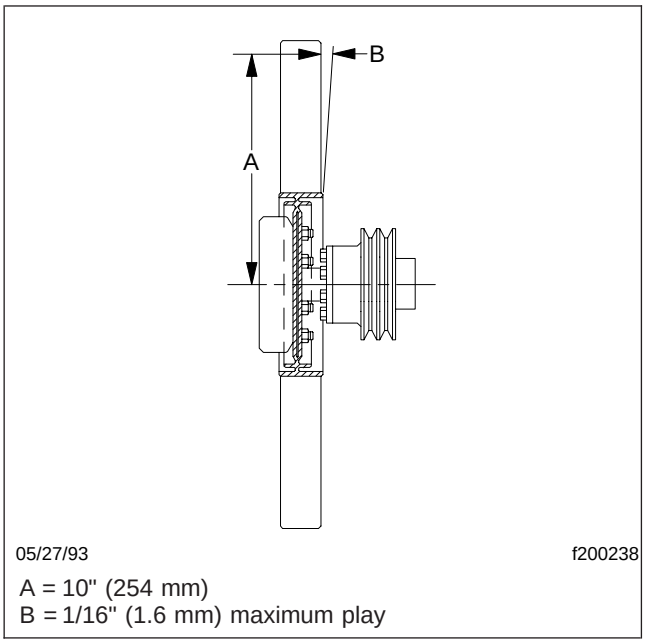
1. Bearing Housing
2. Retaining Plate
3. Fan Pulley
4. Air Inlet (from the solenoid valve)
5. Air Cylinder
6. Fan

Fig. 7, Kysor/Dynair and Kysor K22RA Fan Clutch Lining Wear Checking

Schwitzer Viscous Fan Drive

NOTE: After performing the checks below, if any part of the fan drive requires service or replacement, see **Group 20** of the *Heavy-Duty Trucks Service Manual* for instructions.

1. Check the tightness of the fasteners attaching the fan to the fan drive, and fan drive to the fan hub. For torque values, see **Group 00** of this manual.
2. Check the fan and surrounding area for signs of physical contact between the fan and other parts. If there has been contact, correct the cause. Replace all damaged parts.
3. Check the drive belts for fraying, cracking, and correct tension; see **Group 01** of the *Heavy-Duty Trucks Service Manual*.
4. Turn the fan by hand at least one full turn. It should turn smoothly, with some resistance. If there is binding or jerkiness, or if the fan spins freely, replace the fan drive.
5. Check the fan drive for fluid leakage. Very slight misting and dust accumulation around the pin in the center of the front cover is normal. Any other leakage is abnormal, and will result in poor performance. Replace the fan drive if there is abnormal leakage.
6. Move one blade tip alternately toward and away from the radiator. The allowable play is 1/16 inch (1.6 mm) at a 10-inch (254-mm) radius from the center of the fan. See **Fig. 8**. If there is greater movement, and it can not be traced to loose fasteners or fan hub pulley bearing wear, replace the fan drive.



A = 10" (254 mm)
B = 1/16" (1.6 mm) maximum play

Fig. 8, Checking Schwitzer Viscous Fan Drive Wear

NOTE: When making this check, use only enough force to take up the play in the clutch without bending the blade.

Horton DriveMaster® Fan Clutch

NOTE: If any part of the fan clutch needs to be repaired or replaced after performing the checks below, see **Group 20** of the *Heavy-Duty Trucks Service Manual*.

1. Disconnect the batteries at the negative terminals. Drain all air from the air system. If equipped with an air starter, drain the air starter reservoir.

⚠ WARNING

Make sure the batteries are disconnected before checking the fan clutch. If the engine starts during this procedure, the fan could engage, which could result in serious personal injury.

2. Inspect the electrical connections and wires to the fan clutch solenoid. Secure the connection if loose; replace wires and connectors if damaged.
3. Clean the fan clutch air solenoid valve filter, if equipped.
   - 3.1 Unscrew the fan clutch solenoid valve air filter assembly and remove the filter element.
   - 3.2 Clean the filter element with cleaning solvent.
   - 3.3 Using a clean, lint-free cloth, wipe off any excess solvent.
   - 3.4 Reassemble the clutch valve solenoid air filter assembly and install it on the vehicle.
4. Check the fan for bent, cracked, or damaged blades; replace if damaged. Check for adequate clearance between the fan and other components.
5. Check the fan belt for wear, tension, and alignment. Correct if necessary.
6. Check for wear on the friction facing. Replace the friction facing if it is worn to a 3/16-inch (4.8-mm) thickness or less. Also check the facing for signs of oil contamination or burn marks. If evidence of oil or burn marks are found, replace the friction facing.
7. Connect the battery cables. Start the engine, and charge the air system to 120 psi (827 kPa). Manually engage and disengage the fan clutch.

   Check the fan and the fan clutch from a distance. Look for vibration, fan blade contact, fan clutch slippage, and overall fan clutch operation. If the fan clutch does not operate correctly, see **Group 20** of the *Heavy-Duty Trucks Service Manual* for troubleshooting and repair procedures.
8. With the air system charged to 120 psi (827 kPa), check the fan clutch for audible air leaks, using a suitable listening device.

   Check at the solenoid valve, the air filter assembly, and the air hoses and fittings. See **Fig. 9**. Using a wet finger or a soapy water solution, check for a leak in the same areas.

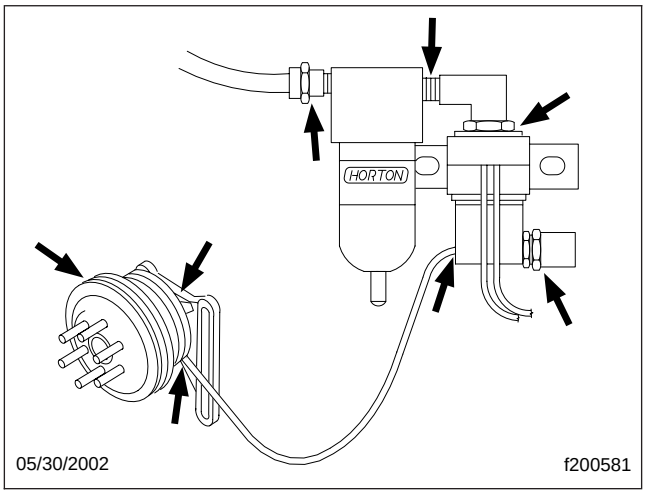


Fig. 9, Checking for Air Leaks (Horton DriveMaster)

9. If a leak is detected, remove the fan blade. Install a new seal kit. See **Group 20** of the *Heavy-Duty Trucks Service Manual* for repair procedures.
10. Check the fan drive for discoloration or any other signs of slipping or overheating.

NOTE: The fan clutch may slip if the air supply pressure is below 70 psi (483 kPa) or if there is a leak inside the fan clutch. Any leak must be remedied.

11. Check the fan clutch bearings.
    - 11.1 Turn the fan in both directions and feel for worn hub bearings.
    - 11.2 If possible, remove the drive belt and check for worn sheave bearings by turning the sheave in both directions.

11.3 If either the hub or sheave bearings are worn, replace them, using a Horton Drive-Master Super Kit.

For instructions and kit part number, see **Group 20** of the *Heavy-Duty Trucks Service Manual*.

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Title of Maintenance Operation (MOP)	MOP Number
Clutch Linkage Components Lubricating	25–03
Clutch Release Bearing Lubricating	25–01
Clutch Release Cross-Shaft Lubricating	25–02

25–01 Clutch Release Bearing Lubricating

NOTE: For a clutch with a sealed release bearing, the release bearing is lubricated at the time of manufacture and requires no additional grease for the life of the bearing. This type of release bearing is not equipped with a grease fitting.

For a clutch with a grease-type release bearing (see **Fig. 1**), wipe the dirt from the grease fitting.

⚠ CAUTION

Do not over-lubricate the clutch release bearing. Over-lubrication could contaminate the clutch internally, causing clutch slippage and premature failure. Do not use chassis grease or multipurpose lubricants.

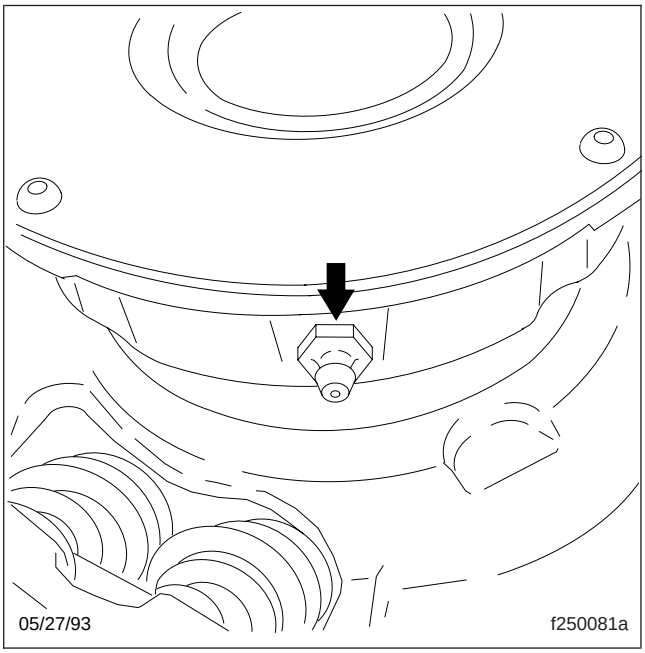


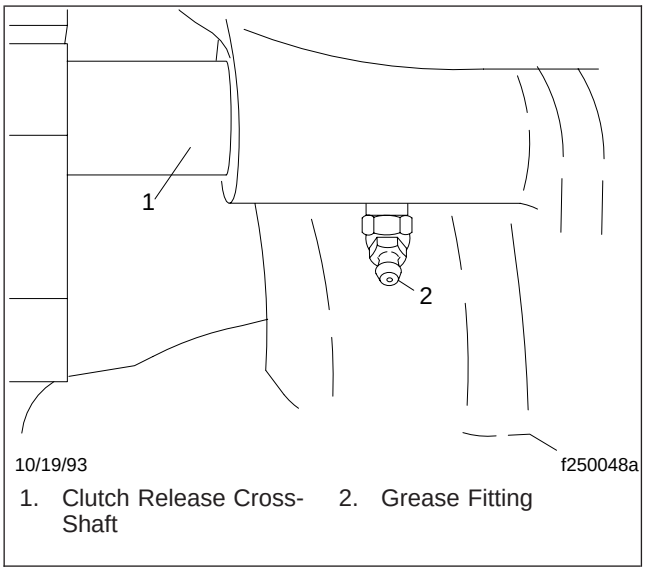
Fig. 1, Release Bearing Grease Fitting

IMPORTANT: If the release bearing is *not* equipped with a grease-fitting extension that extends outside the bell housing, lubricate the bearing with the engine stopped. If equipped with a grease-fitting extension that does extend outside the bell housing, lubricate the bearing with the engine running.

Using a pressure gun and high-temperature grease only, lubricate the release bearing at the grease fitting until grease starts coming out of the fitting. *Do not* use chassis lube or multipurpose lubricants.

25–02 Clutch Release Cross-Shaft Lubricating

The clutch release cross-shaft is equipped with two grease fittings in the transmission clutch housing. See **Fig. 2** and **Fig. 3**. Wipe the dirt from the grease fittings. Using a pressure gun, lubricate the clutch release cross-shaft with multipurpose chassis grease.



1. Clutch Release Cross-Shaft
2. Grease Fitting

Fig. 2, Cross-Shaft Grease Fitting, Left-Side

25–03 Clutch Linkage Components Lubricating

FLA/FLB Clutch Linkage

For earlier FLAs, the clutch linkage is equipped with four grease fittings, one at each rod end spherical bearing. See **Fig. 4**, **Fig. 5**, and **Fig. 6**. Wipe the dirt from the grease fittings. Using a pressure gun, lubricate the clutch linkage with multipurpose chassis grease.

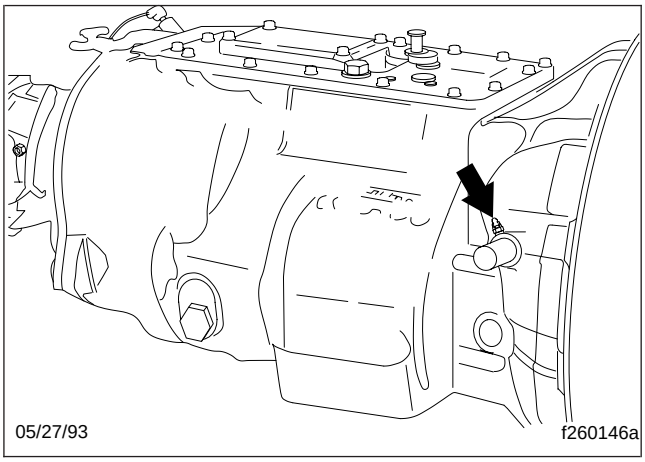


Fig. 3, Cross-Shaft Grease Fitting, Right-Side

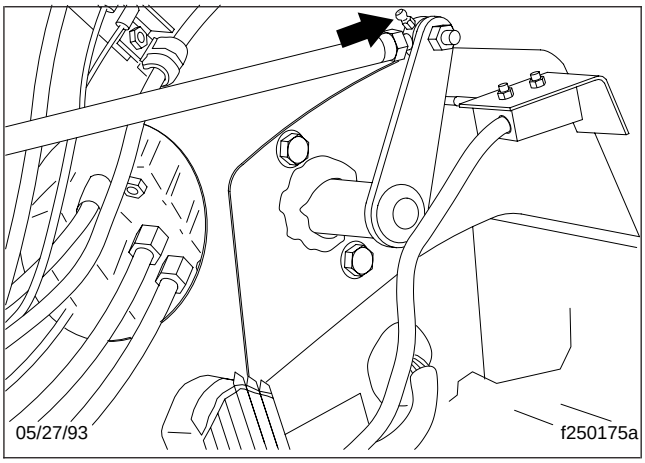


Fig. 4, Earlier FLA Clutch Pedal Lever Grease Fitting

Later FLAs and all FLBs are equipped with a grease fitting on the inboard side of the bellcrank pivot pin. See **Fig. 7**. Wipe the dirt from the fitting. Using a pressure gun, lubricate the pivot pin with multipurpose chassis grease.

Some FLAs are equipped with a grease fitting on the clutch pedal shaft. Wipe the dirt from the fitting. Using a pressure gun, lubricate the clutch pedal shaft with multipurpose chassis grease.

FLB Right-Hand Drive

On right-hand drive FLBs, there are three additional lubrication points on the clutch linkage crossover shaft.

Remove the plastic cap from the grease fitting on both the left-hand and right-hand crossover shaft

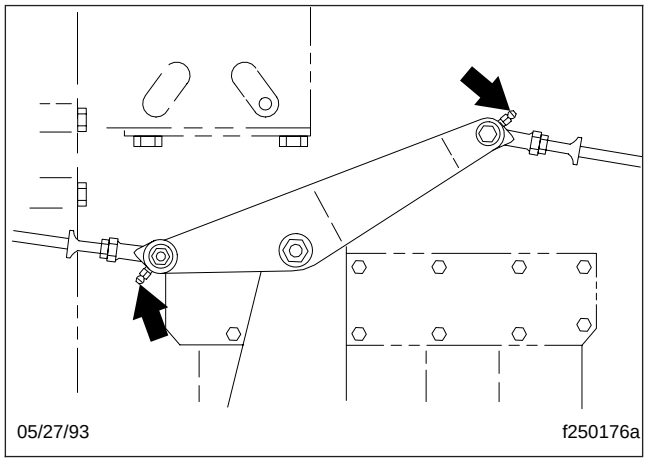
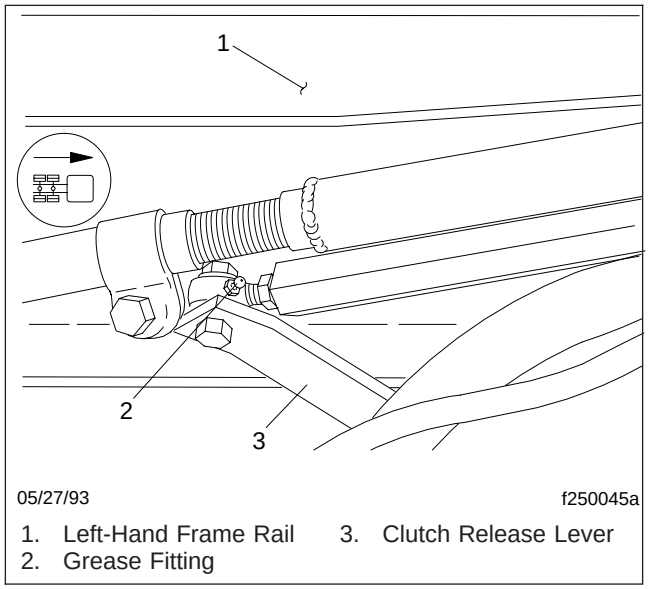


Fig. 5, Earlier FLA Clutch Intermediate Bellcrank Grease Fittings



1. Left-Hand Frame Rail
2. Grease Fitting
3. Clutch Release Lever

Fig. 6, Earlier FLA Clutch Release Lever Grease Fitting

bearings. Using a pressure gun, lubricate each bearing with multipurpose chassis grease. See **Fig. 8**.

Locate the grease fitting on the side of the steering column bracket at the end of the crossover shaft lube tube. Using a pressure gun, lubricate the tube with multipurpose chassis grease. See **Fig. 9**.

FLD Clutch Linkage

The FLD clutch linkage is equipped with two grease fittings. See **Fig. 10** and **Fig. 11**.

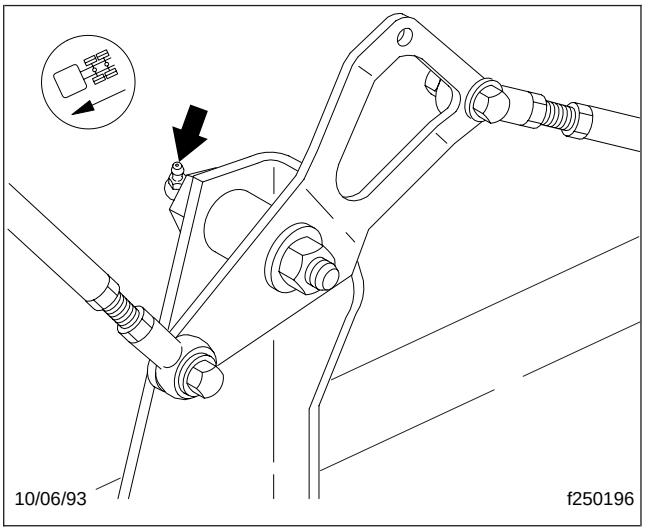
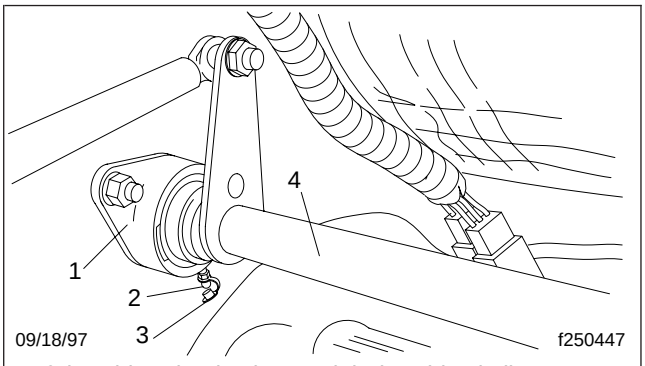


Fig. 7, FLB and Later FLA Bellcrank Pivot Pin Grease Fitting



Left-hand bearing is shown; right-hand is similar.

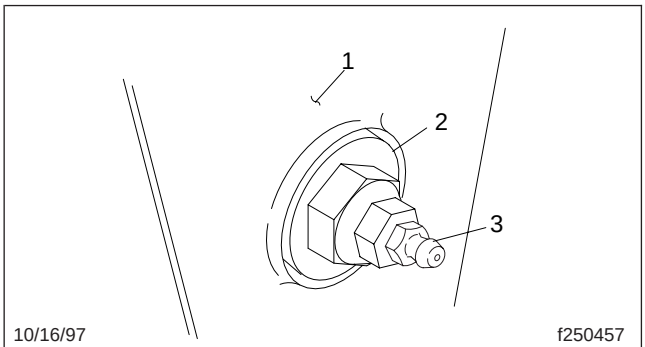
1. Bearing
2. Grease Fitting
3. Plastic Cap
4. Crossover Shaft

Fig. 8, Crossover Shaft Bearing Grease Fitting, FLB Right-Hand Drive

Wipe the dirt from the grease fittings. Using a pressure gun, lubricate the clutch linkage with multipurpose chassis grease.

FLC Clutch Linkage

The FLC clutch relay lever is equipped with one grease fitting at the center of the shaft. See **Fig. 12.** Wipe the dirt from the fitting. Using a pressure gun, lubricate the clutch relay lever with multipurpose chassis grease.



1. Steering Column Bracket
2. Crossover Shaft Lube Tube
3. Grease Fitting

Fig. 9, Lube Tube Grease Fitting, FLB Right-Hand Drive

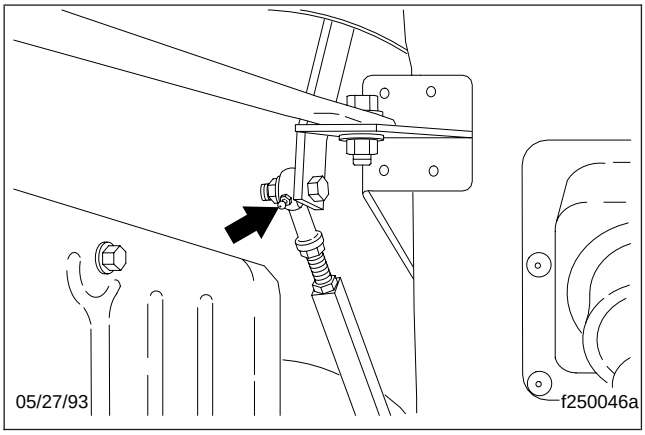
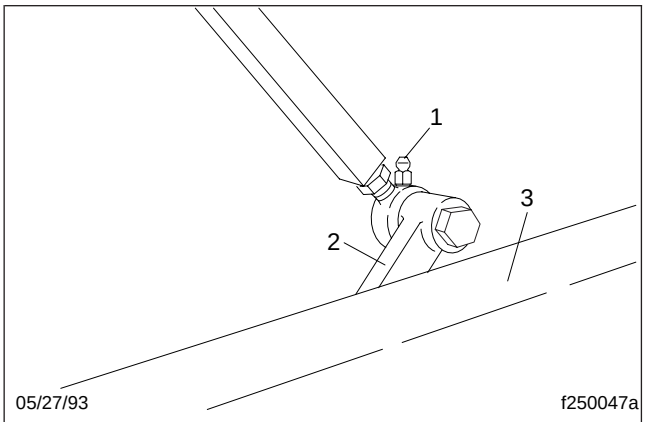


Fig. 10, FLD Clutch Pedal Lever Grease Fitting



1. Grease Fitting
2. Clutch Release Lever
3. Left-Hand Frame Rail

Fig. 11, FLD Clutch Release Lever Grease Fitting

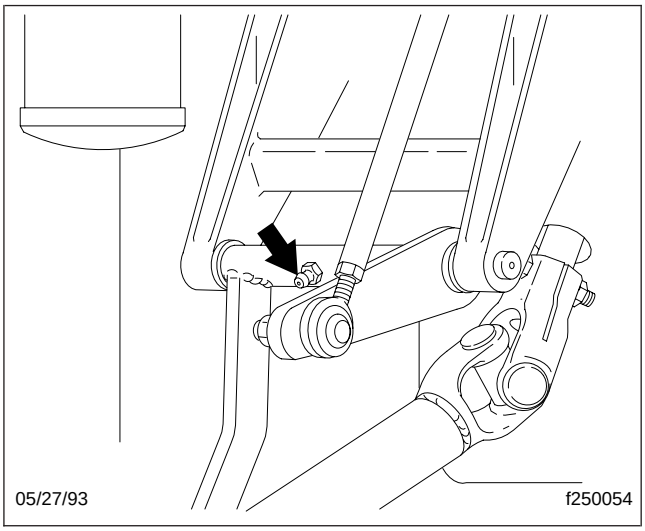


Fig. 12, FLC Clutch Relay Lever Grease Fitting

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
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Shift Lever Pivot Yokes Inspecting, FLA/FLB	26–03
Transmission Air Filter/Regulator Checking, and Cleaning or Replacing	26–07
Transmission Oil Level Checking and Breather Checking	26–08

26–01 Shift Control Telescoping Tubes Lubricating and Inspecting, FLA/FLB

1. Apply the parking brakes, and chock the tires.
2. Tilt the cab to the full-tilt position, using the instructions in **Group 00** of this manual.
3. Wipe off the telescoping tubes (**Fig. 1**) with a clean cloth.
4. Inspect the tubes for wear or damage. If worn or damaged, replace them with new ones. See **Group 26** of the *Heavy-Duty Trucks Service Manual* for procedures.
5. Inspect the O-ring located near the top of the telescoping tubes. See **Fig. 2**. If worn or damaged, install a new O-ring. See **Group 26** of the *Heavy-Duty Trucks Service Manual* for procedures.
6. Apply a light coating of multipurpose chassis grease on the surfaces of the telescoping tubes.
7. Return the cab to the upright and locked position using the instructions in **Group 00** of this manual.
8. Remove the chocks from the tires.

26–02 Shift Control Latch Lubricating and Cylinder Inspecting, FLA/FLB

1. Apply the parking brakes, and chock the tires.
2. Tilt the cab using the instructions in **Group 00** of this manual.
3. Check the latch cylinder for signs of leakage. See **Fig. 2**. If leaking, replace it with a new one. See **Group 26** of the *Heavy-Duty Trucks Service Manual* for procedures.
4. Inspect the latch arm and locking tab areas on the shift control tube assembly for wear. See **Fig. 3**. Replace any worn parts. See **Group 26** of the *Heavy-Duty Trucks Service Manual* for procedures. Lubricate the latch arm, locking tab, and latch guide with a light coating of chassis grease.
5. Return the cab to the upright and locked position using the instructions in **Group 00** of this manual.
6. Remove the chocks from the tires.

26–03 Shift Lever Pivot Yokes Inspecting, FLA/FLB

1. Remove the tunnel top cover.
2. Remove the screws that attach the center console tray.
3. Remove the lower cover from the shift knob, then disconnect the air lines from the shift knob.
4. Loosen the locknut and remove the shift knob.
5. Remove the screws that attach the shift boot to the tunnel, then remove the shift boot.
6. Using a 0.062-inch (1.6-mm) feeler gauge, check the clearance between the pivot block yoke and pivot block. Also, check the clearance between the shift lever yoke and the shift lever. See **Fig. 4**.

   If the shift lever yoke clearance is more than 0.062 inch (1.6 mm), and the nylon washer is not worn out, tighten the yoke nut 100 lbf·in (1130 N·cm) then back it off 1/4 turn. If the nylon washer is worn, remove the shift lever assembly, and replace the worn parts. See **Group 26** of the *Heavy-Duty Trucks Service Manual* for procedures.

   If the pivot block yoke clearance is more than 0.062 inch (1.6 mm), remove the shift lever assembly, and replace the worn parts. See **Group 26** of the *Heavy-Duty Trucks Service Manual* for procedures.

26–04 Selection Lever and Pivot Rod Ball Stud Lubricating, FLA/FLB

Wipe off the selection lever and pivot rod ball stud grease fittings. See **Fig. 5**. Apply multipurpose chassis grease with a pressure gun at each fitting until new grease appears at the seals.

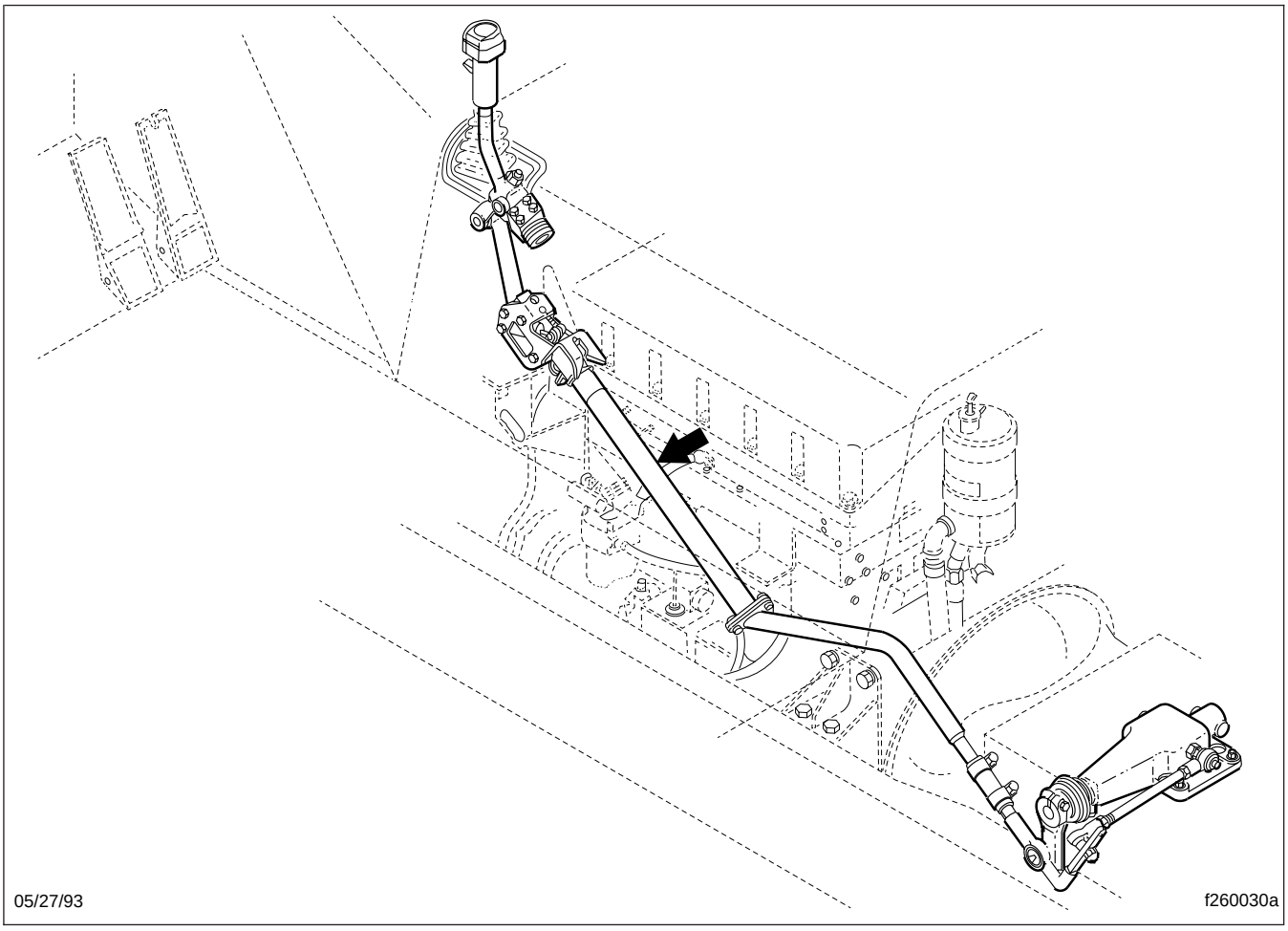


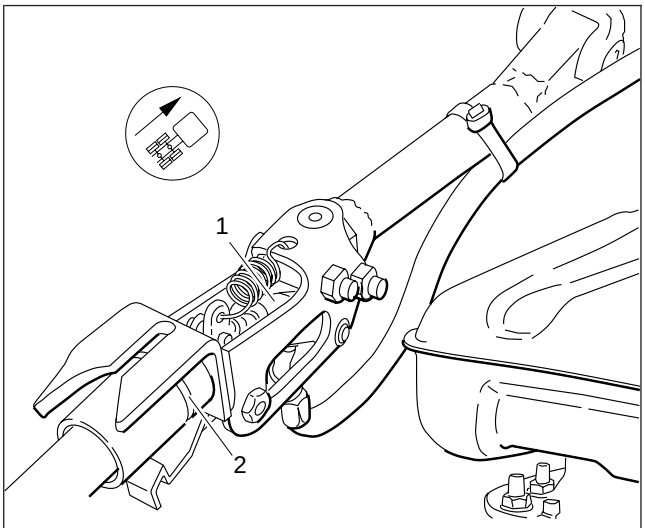
Fig. 1, Telescoping Tubes of the FLA/FLB Tunnel-Mounted Shifter

26–05 Allison Transmission Fluid and Filter Changing

When draining transmission fluid, check for evidence of dirt or water contamination. A small amount of condensation will appear in the fluid during operation.

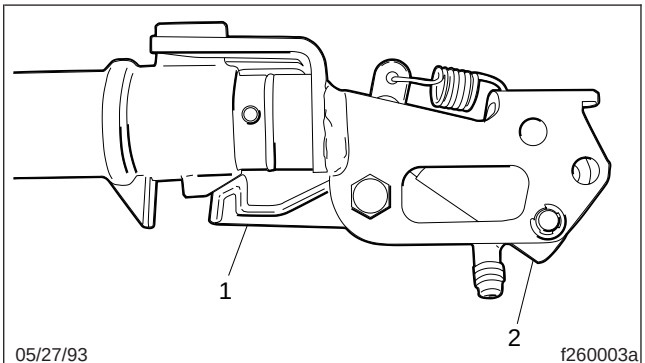
Water contamination is normally characterized as a milky discoloration of the transmission fluid. Obvious contamination of the transmission fluid indicates a leak between the water and fluid areas of the transmission cooler. Inspect and pressure-test the cooler to confirm the leak; replace leaking transmission coolers.

1. Park the vehicle on a level surface. Apply the parking brakes, and chock the tires.
2. Operate the vehicle until the transmission reaches normal operating temperature: 160 to 200°F (71 to 93°C).
3. Clean the area around the drain plug and the transmission fluid pan. Place a drain pan under the transmission and remove the drain plug. Examine the fluid as it drains. If only the filter is being changed, do not drain the fluid.
4. Remove the 12 mounting bolts (six each) from the two filter covers.
5. Remove the filter covers, O-rings, and two square-cut seals from the transmission. See **Fig. 6**.



1. Latch Cylinder
2. O-Ring

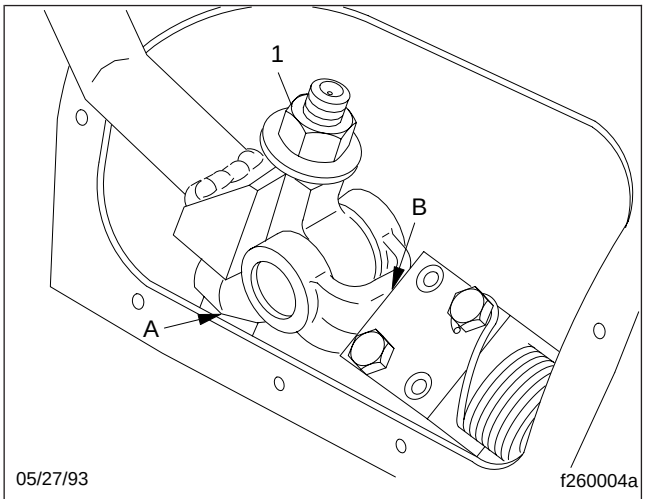
Fig. 2, Shift Control Latch Cylinder



1. Latch Arm
2. Latch Cylinder Pivot Pin

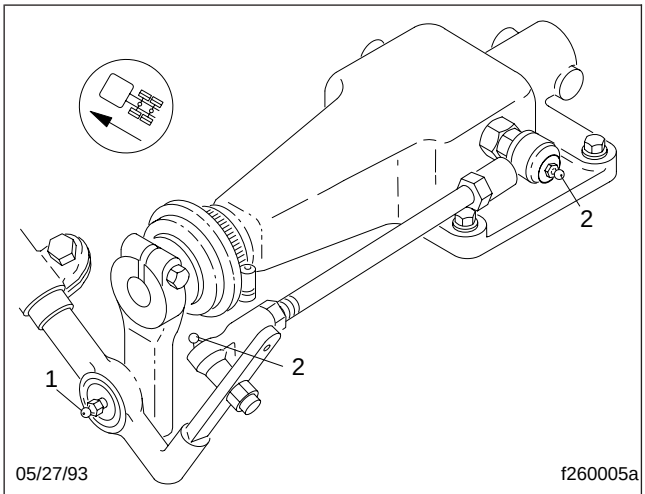
Fig. 3, Shift Control Latch Arm and Locking Tab

6. Remove the filters from the bottom of the control module.
7. Lubricate the new O-rings with transmission fluid, and install them on the cover assemblies.
8. Install a new square-cut seal on each cover assembly, and install the fluid filter elements on the cover assemblies.
9. Install the filter and cover assemblies into the filter compartment.



A. Check shift lever yoke clearance here.
B. Check pivot block yoke clearance here.
1. Shift Lever Yoke Nut

Fig. 4, Shift Lever and Pivot Block Yokes



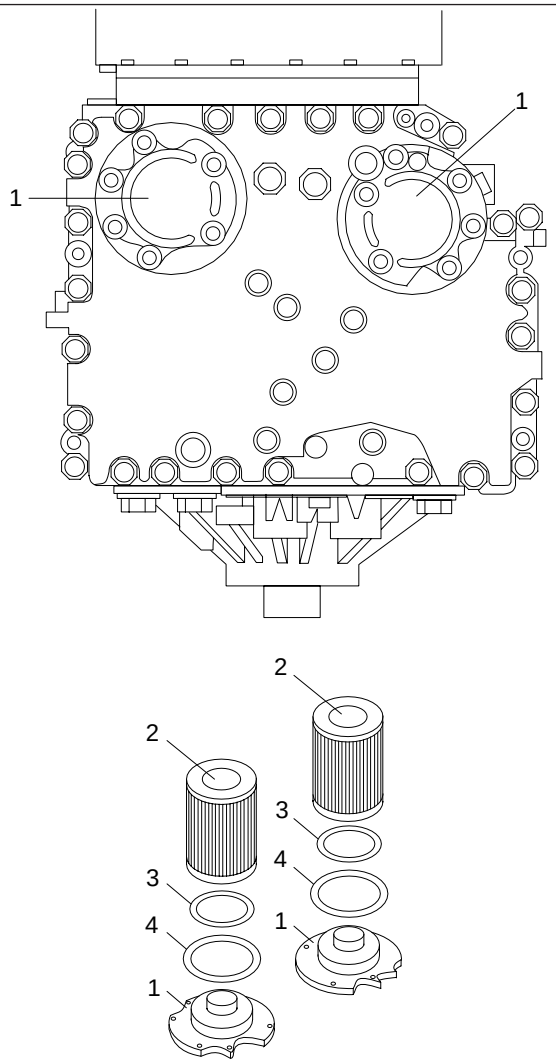
1. Selection Lever Ball Stud Grease Fitting
2. Pivot Rod Ball Stud Grease Fitting

Fig. 5, Selection Lever and Pivot Rod Ball Studs

10. Align each cover assembly with the holes in the channel plate sump, and push the cover assemblies in by hand to seat the seals.

⚠ CAUTION

Do not use the bolts to draw the filter covers to the sump. This can damage the covers, seals, or sump.



1. Filter Cover
2. Filter Element
3. Filter Element O-Ring
4. Square-Cut Seal

Fig. 6, Allison Transmission Filter Location and Components

11. Install six bolts in each cover, and torque the bolts 38 to 44 lbf·ft (51 to 61 N·m).
12. Replace the drain plug O-ring, and install the drain plug. Tighten the drain plug 18 to 24 lbf·ft (25 to 32 N·m).
13. Refill the transmission with fresh Dexron® III transmission fluid and check the fluid level.

NOTE: Do not overfill the transmission. Follow instructions in **Maintenance Operation 26–08**.

26–06 Manual Transmission Magnetic Plug Cleaning, Oil Changing, and Oil Filter Element Changing

Manual Transmission Oil Changing

IMPORTANT: For all transmissions that are filled with approved synthetic lubricants, the lubricant must be changed every 500,000 miles (800 000 km). Transmissions with petroleum-based lubricants must have the lubricant changed at each Maintenance 2 (M2) interval. All transmissions with synthetic or petroleum-based lubricants must have the transmission breather checked and the magnetic plugs cleaned at each M1 interval.

NOTE: For vehicles equipped with auxiliary transmissions, use this procedure to change the auxiliary transmission oil and to check the auxiliary transmission breather whenever changing the main transmission oil and checking the main transmission breather.

1. With the vehicle parked on level ground, apply the parking brakes, and chock the tires. Place a large drain pan under the transmission.
2. Clean the area around the fill plug, and remove it from the side of the case. Remove each drain plug from the bottom of the transmission case. Drain the oil while the transmission is warm.
3. Clean the fill and drain plugs. For magnetic plugs, use a piece of key stock or any other convenient steel slug to short the two magnetic poles and divert the magnetic field.
4. Install and tighten each drain plug 50 lbf·ft (68 N·m).
5. Transmission housing breathers must remain clear. A plugged breather could result in pressure build-up, which could cause oil leakage. If the breather is plugged, clean or replace it. See

Fig. 7. Check more often if the vehicle operates under very dusty conditions.

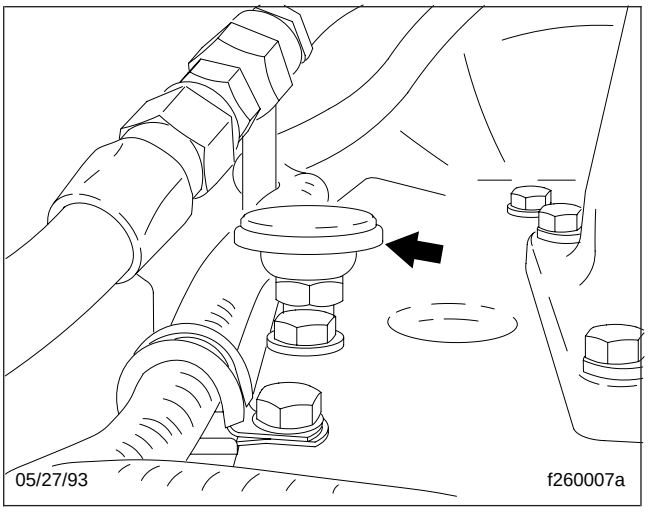


Fig. 7, Transmission Breather (Fuller shown)

NOTE: For a Fuller transmission equipped with an oil filter(s), change the filter as instructed under "Fuller Transmission Oil Filter Element Changing", before filling the transmission with oil.

IMPORTANT: Do not mix types and brands of oil, because of possible incompatibility. Do not use oil additives, friction modifiers, extreme-pressure gear oils, or multiviscosity lubricants. Do not use extreme-pressure additives, such as those found in multipurpose or rear-axle-type lubricants. These additives are not required, and may create transmission problems. Multipurpose oils have relatively poor oxidation stability, a high rate of sludge formation, and a greater tendency to react on or corrode steel and bronze parts.

NOTE: The correct oil capacity is established by the fill opening.

6. Add oil until it is level with the lower edge of the fill opening. If the transmission has two fill openings, add oil to the level of both openings. See **Fig. 8**. See **Table 1** for transmission lubricant capacities, and see **Table 2** for approved transmission lubricants.

CAUTION

Operating a Fuller or Spicer transmission with the oil level higher or lower than recommended can result in transmission damage. Do not overfill the transmission. On Fuller transmissions, overfilling will force oil out of the case through the main shaft openings. On Spicer transmissions, overfilling usually causes oil breakdown, due to excessive heat and aeration from the churning action of the gears. Early breakdown of the oil causes heavy varnish and sludge deposits that plug oil ports and build up on splines and bearings. Oil overflow may also drain onto the clutch or clutch brake, causing additional problems.

7. For a transmission equipped with an oil pump or an oil cooler, operate the engine for five minutes after filling the transmission, then check the oil level again.
8. Install the fill plug, then tighten it 50 lbf·ft (68 N·m).
9. Operate the vehicle to check for correct operation.

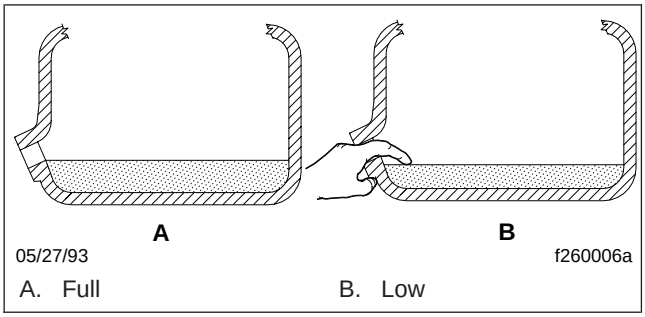


Fig. 8, Checking Transmission Oil Level

Transmission Lubricant Capacities	
Transmission Make and Model	**Capacity: pt (L)**
ALLISON	
HD4060/4560 w/shallow sump	80 (38)
HD4060/4560 w/standard sump	96 (45)
FULLER AUXILIARY	
AT–1202	11 (5.2)
FULLER 7-SPEED	
T–8607A/B	36 (17.0)
T–11607A	30 (14.2)

Transmission Lubricant Capacities	
Transmission Make and Model	**Capacity: pt (L)**
T/TX–14607A/B	36 (17.0)
FULLER 8-SPEED	
RTO–11607L	28 (13.2)
RT–11608	26 (12.3)
RT–14608	28 (13.2)
FULLER 9-SPEED	
RTO–11607LL	31 (14.7)
RTO–11707LL /DLL	28 (13.2)
RT–8608L	27 (12.8)
RT–8609	15 (7.1)
RT/RTO/RTX–11609A/B/P/R	27 (12.8)
RT/RTX–11709H	26 (12.3)
RT/RTO/RTX–12609A/B/P/R	27 (12.8)
RT/RTX–12709H	27 (12.8)
RT/RTX–13609A/B/P/R	27 (12.8)
RT/RTX–13709H	27 (12.8)
RT/RTO/RTX–14609A/B/P/R	27 (12.8)
RT/RTX–14709H	26 (12.3)
RTX–16709B/H	27 (12.8)
FULLER 10-SPEED	
RT–7608LL	19.5 (9.2)
RTO–11608LL	29 (13.7)
RTO/RTX–11708LL	28 (13.2)
RTO–14608LL	29 (13.7)
RTO/RTX–14708LL	28 (13.2)
RT/RTO/RTX–11610	26 (12.3)
RT/RTX–11710B/C	26 (12.3)
RT–12610	26 (12.3)
RTLO–12610B	28 (13.2)
RT/RTX–12710B/C	26 (12.3)
RTLO–13610B	28 (13.2)
RT/RTX–13710B/C	26 (12.3)
RT/RTO/RTX–14610	26 (12.3)
RTLO–14610A/B	28 (13.2)
RT/RTX–14710B/C	26 (12.3)
RTLO–15610B	28 (13.2)

Transmission Lubricant Capacities	
Transmission Make and Model	**Capacity: pt (L)**
RTX–15710B/C	26 (12.3)
RTX–16710B/C	26 (12.3)
FULLER 13-SPEED	
RT/RTO/RTX–11613	28 (13.2)
RTLO–12713A	28 (13.2)
RT/RTO–14613	29 (13.7)
RTLO–14613B	28 (13.2)
RTLO–14713A	28 (13.2)
RT/RTO–15613	29 (13.7)
RTLO–16713A	28 (13.2)
FULLER 15-SPEED	
RT/RTO–11615	28 (13.2)
RT/RTO/RTX–11715	28 (13.2)
RT/RTO–14615	30 (14.2)
RT/RTO/RTX–14715	28 (13.2)
RT/RTO–15615	30 (14.2)
RT/RTO/RTX–15715	28 (13.2)
FULLER 18-SPEED	
RTLO–14618A	28 (13.2)
RTO–15618	28 (13.2)
RTLO–16618A	28 (13.2)
MERITOR 9-SPEED	
RM9/RMO9/RMX9–115A/B/R	18 (8.5)
RM9/RMO9/RMX9–125A/B/R	18 (8.5)
RM9/RMO9/RMX9–135A/B/R	18.5 (8.75)
RM9/RMO9/RMX9–145A/B/R	18.5 (8.75)
RM9/RMX9–155A/B	18.5 (8.75)
MERITOR 10-SPEED	
RMX10–115A	18 (8.5)
RMX10–125A	18 (8.5)
RMX10–135A	18.5 (8.75)
RMX10–145A	18.5 (8.75)
RMX10–155A	18.5 (8.75)
MERITOR 13-SPEED	
RMO13–145A	20 (9.5)
SPICER AUXILIARY—4-SPEED	

Transmission Lubricant Capacities	
Transmission Make and Model	**Capacity: pt (L)**
AMO1000-4 Series & APO1000-4 Series (formerly 1241 Series)	14 (6.6)
SPICER (SST-2 Series) 5-SPEED	
1452A, 1453A, and PS130–5A	38 (18.0)
SPICER (SST-2 Series) 6-SPEED	
PS130–6B & PSO140–6A (formerly 1362B & 1463A)	41 (19.4)
SPICER (SST-2 Series) 6+1 SPEED	
1207–2A	30 (14.2)
SPICER (SST-2 Series) 7-SPEED	
PS140–7A & PS125–7B (formerly 1372A & 1372B)	48 (22.7)

Transmission Lubricant Capacities	
Transmission Make and Model	**Capacity: pt (L)**
SPICER (SST-2 Series) 10-SPEED	
1310–2A	41 (19.4)
SPICER (SST-2 Series) 12-SPEED	
PSO140–12B (formerly 1420)	30 (14.2)
SPICER (SST-2 Series) 14-SPEED	
1414–2A & –3A	30 (14.2)
SPICER (SST-2 Series) 20-SPEED	
PSO140–12B (formerly 1420–3B)	30 (14.2)

Table 1, Transmission Lubricant Capacities

Approved Transmission Lubricants			
Transmission Make	**Lubricant Type***	**Temperature**	**SAE Viscosity**
ALLISON	Dexron® III	Above -17°F (–27°C)	—
FULLER	Heavy-Duty Engine Oil meeting MIL–L–2104B,C, or D, or API Service Classification SF or CD (previous API designations are acceptable)	Above +10°F (–12°C)	50 or 40
		Below +10°F (–12°C)	30
	Mineral Gear Oil with Rust and Oxidation Inhibitor API–GL–1	Above +10°F (–12°C)	90
		Below +10°F (–12°C)	80W
ROCKWELL	Heavy-Duty Engine Oil meeting API Service Classification SF or SG, or API Service Classification CD or CE, or MIL–L–2104B,C, or D	Above +10°F (–12°C)	50 or 40
		Below +10°F (–12°C)	30
	Mineral Gear Oil with Rust and Oxidation Inhibitor API–GL–1	Above +10°F (–12°C)	90
		Below +10°F (–12°C)	80
	Synthetic Engine Oil meeting Meritor Specification 0–81	All	50
SPICER	Heavy-Duty Engine Oil meeting MIL–L–2104D or MIL–L–46152B, or API Service Classification SF or CD (MIL–L–2104B and C, or MIL–L–46152 are acceptable)	Above 0°F (–18°C)	30, 40, or 50
		Below 0°F (–18°C)	30
	Mineral Gear Oil with Rust and Oxidation Inhibitor API–GL–1	Above 0°F (–18°C)	90
		Below 0°F (–18°C)	80
	Synthetic Engine Oil meeting MIL–L–2104D or MIL–L–46152B, or API Service Classification SF or CD	All	50 or 30

* Lubricants listed in order of preference. Do not mix types or brands of oil. Multi-weight and extreme-pressure gear oils are not recommended.

Table 2, Approved Transmission Lubricants

Fuller Transmission Oil Filter Element Changing

1. After draining the transmission case, remove the attaching bolts and filter cover from either one or both power take-off openings in the case.
2. Remove and discard the filter element(s).
3. Install the new filter element in the power take-off opening in the case.
4. Attach the cover to the case with the attaching bolts. See **Group 00** in this manual for torque values.
5. Fill the transmission with recommended clean oil, as instructed under "Manual Transmission Oil Changing."

26–07 Transmission Air Filter/ Regulator Checking, and Cleaning or Replacing

Fuller Transmission

⚠ WARNING

Drain the air supply; if the air supply is not drained before the air filter/regulator is serviced, serious injury and component damage could result.

1. Apply the parking brakes and chock the tires. Drain the air from the air reservoirs.
2. Clean the outside of the air filter/regulator with cleaning solvent, then let it air dry. See **Fig. 9**.
3. Remove the end cap, large O-ring, and filter element from the filter housing. See **Fig. 10**. Remove the small O-ring from the end cap.

NOTE: Do not remove, disassemble, or adjust the air regulator. If the air regulator is not keeping the air pressure between 58 and 63 psi (400 and 434 kPa), replace the air filter/regulator, which is not serviceable.

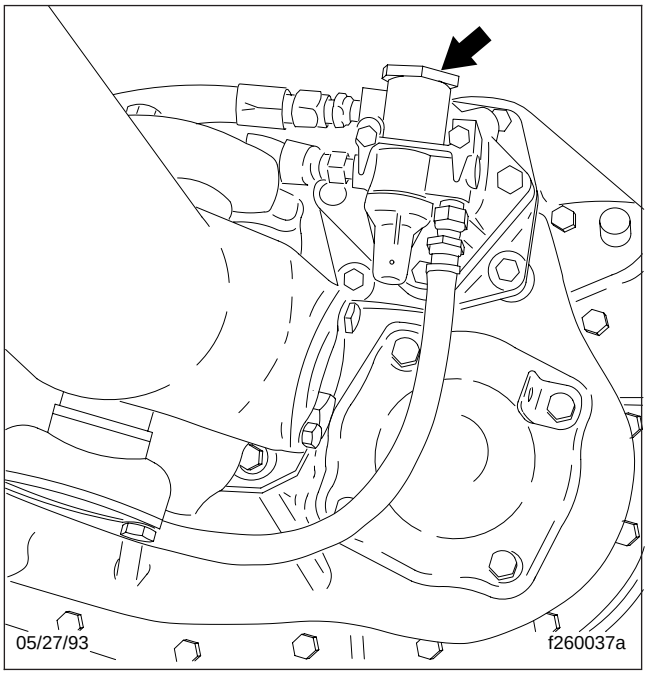
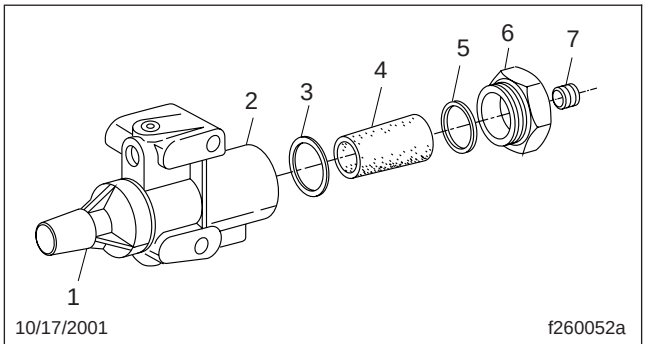


Fig. 9, Air Filter/ Regulator Location (Fuller transmission shown)



1. Air Regulator
2. Housing
3. Large O-Ring
4. Filter Element
5. Small O-Ring
6. End Cap
7. Plug

Fig. 10, Eaton Fuller Transmission Air Filter/Regulator Components

⚠ WARNING

Wear eye protection when using compressed air to clean parts, as permanent harm to eyes could result from flying debris.

4. Clean the filter element by dipping it in alcohol or other cleaning solvent. Blow compressed air through the filter element (inside to outside) to loosen surface dirt and to dry the element. If it is not damaged, the sintered metallic filter element will last the life of the vehicle.

   Wipe out the filter housing with a clean, dry, lint-free rag. Clean and inspect the O-rings and the end cap. Replace any parts that are damaged.

5. Install the large O-ring, then the filter element (small end first) into the filter housing.
6. Install the small O-ring in the end cap, then install the end cap and tighten it 8 to 12 lbf·ft (11 to 16 N·m).
7. Start the engine, and build pressure in the air system. Check for air leaks at the filter housing and air line connections; repair any leaks.

CAUTION

A leaking air filter or air lines can cause slow or hard shifting of the transmission, and eventual transmission damage.

Spicer Transmission

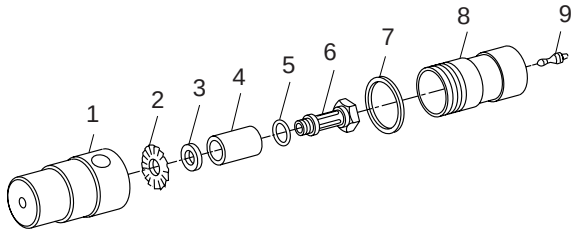
WARNING

Drain the air supply; if the air supply is not drained before the air filter/regulator is serviced, serious injury and component damage could result.

1. Apply the parking brakes, and chock the tires. Drain the air from the air reservoirs.
2. Clean the outside of the air filter/regulator (**Fig. 11**) with cleaning solvent, then let it air dry.
3. Loosen or remove the air filter/regulator bracket clamp, then unscrew the bowl; hold the regulator to prevent it from turning. Remove the O-ring.
4. Unscrew the stud from the regulator. Remove the louver, upper gasket, element, and lower gasket from the stud.

WARNING

Wear eye protection when using compressed air to clean parts, as permanent harm to eyes could result from flying debris.



1. Regulator
2. Louver
3. Upper Gasket
4. Element
5. Lower Gasket
6. Stud
7. O-Ring
8. Bowl
9. Drain Valve

Fig. 11, Spicer Transmission Air Filter/Regulator Components

5. Clean and inspect all parts. Use only a petroleum-based solvent to clean the parts. Blow air through the filter element (inside to outside) to loosen surface dirt.

IMPORTANT: After three cleanings, replace the filter element with a new one.

Do not disassemble the regulator, as it is not repairable. If the air regulator does not work properly, replace the unit.

6. Install the lower gasket, the cleaned or new element, the upper gasket, and the louver, on the stud. Install the element so the large end of the internal taper (thinnest wall section) is toward the hex on the stud.
7. Install and tighten the stud 5 to 10 lbf·in (60 to 100 N·cm).
8. Apply a light coat of Dow Corning DC7 silicone grease, or an equivalent, to the O-ring seating surfaces on the regulator and the bowl.
9. Apply a light, even coat of Molykote "G," or an equivalent, to the bowl threads. Install and tighten the bowl 5 to 10 lbf·in (60 to 100 N·cm).
10. Install and/or tighten the air filter/regulator bracket clamp.
11. Install and torque the drain valve, if removed, 10 to 15 lbf·in (120 to 160 N·cm).
12. Build air pressure in the system, check for leaks, and make any necessary repairs.

Meritor Transmission

WARNING

Drain the air supply; if the air supply is not drained before the air filter/regulator is serviced, serious injury and component damage could result.

1. Apply the parking brakes and chock the tires. Drain the air from the air reservoirs.
2. Clean the outside of the air filter/regulator with cleaning solvent, then let it air dry.
3. Remove the end cap from the air filter/regulator assembly, then inspect the O-rings in the end cap. Replace worn or damaged O-rings.
4. Remove the element from the filter/regulator assembly.
5. Inspect the element for oil. If oil is in the element, replace the element. Inspect the air supply system for the source of oil, and service it as needed.
6. Install the element in the filter/regulator assembly.
7. Apply a light coat of Dow Corning DC7 silicone grease, or an equivalent, to the O-rings in the end cap.
8. Install and tighten the end cap 10 to 15 lbf·ft (14 to 20 N·m).
9. Build air pressure in the system, check for leaks, and make any needed repairs.

26–08 Transmission Oil Level Checking and Breather Checking

NOTE: For vehicles with auxiliary transmissions, use this procedure to check the auxiliary transmission oil level and breather whenever checking the main transmission oil level and breather.

Breather Checking

Transmission housing breathers must remain clear. A plugged breather could result in pressure build-up, which could cause oil leakage.

If the breather is plugged, clean or replace it. See **Fig. 7**. Check more often if the vehicle operates under very dusty conditions.

Allison Transmission

CAUTION

Operating a transmission with the fluid level higher or lower than recommended can result in transmission damage. Do not overfill the transmission.

Do not mix types and brands of fluid, because of possible incompatibility. Do not use fluid additives, friction modifiers, extreme-pressure gear fluids, or multiviscosity lubricants.

Cold Check

Clean all dirt from around the end of the fluid fill tube before removing the dipstick. Do not allow foreign matter to enter the transmission. Dirt or foreign matter in the hydraulic system may cause undue wear of transmission parts, make valves stick, and clog passages.

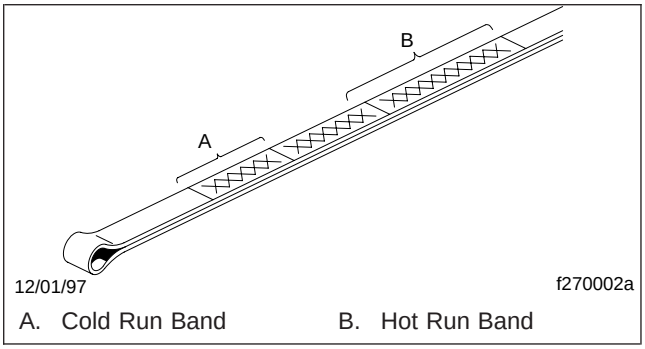
It is important to check the fluid level while cold to determine if the transmission has a sufficient amount of fluid to be safely operated until a hot check can be performed.

1. Park the vehicle on a flat, level surface.
2. Apply the parking brake and chock the tires.
3. Run the engine for at least one minute.
4. Shift from DRIVE to NEUTRAL, and then shift to REVERSE to fill the hydraulic system.
5. Shift to NEUTRAL and allow the engine to idle at 500 to 800 rpm.
6. With the engine running at idle, remove the dipstick from the tube and wipe it clean.
7. Insert the dipstick into the tube and remove the dipstick.
8. Check the fluid level reading and repeat the check procedure to verify the reading.

   If the fluid level is within the COLD RUN band, the transmission may be operated until the fluid is hot enough to perform a hot check.

   If the fluid level is not within the COLD RUN band, add or drain fluid as needed to adjust the

fluid level to the middle of the COLD RUN band. See **Fig. 12**.



A. Cold Run Band B. Hot Run Band

Fig. 12, Dipstick Markings

CAUTION

As the fluid temperature increases, so does the fluid level. Do not fill above the COLD RUN band if the transmission fluid is below normal operating temperature.

NOTE: Perform a hot check at the first opportunity after the normal operating temperature, 160 to 200°F (71 to 93°C), has been reached.

Hot Check

1. Park the vehicle on a flat, level surface. Apply the parking brake and chock the tires.
2. Shift the transmission to NEUTRAL.
3. Operate the engine at idle (500 to 800 rpm) until normal operating temperature is reached. Check that the sump temperature is 160 to 200°F (71 to 93°C). Check that the converter-out temperature is 180 to 220°F (82 to 104°C).
4. With the engine idling, remove the dipstick from the tube and wipe it clean.
5. Insert the dipstick into the tube and remove the dipstick.
6. Check the fluid level reading and repeat the check procedure to verify the reading. Safe operating level is within the HOT RUN band on the dipstick. The HOT RUN band is between the HOT FULL and HOT ADD marks.

   If the fluid level is not within the HOT RUN band, add or drain fluid as needed to bring the fluid level within the HOT RUN band. See **Fig. 12**.

Eaton/Fuller Transmission

CAUTION

Operating a transmission with the fluid level higher or lower than recommended can result in transmission damage. Do not overfill the transmission. Overfilling will force fluid out of the case through the main shaft openings.

Do not mix types and brands of fluid, because of possible incompatibility. Do not use fluid additives, friction modifiers, extreme-pressure gear fluids, or multiviscosity lubricants.

With the transmission at operating temperature, and the vehicle on a level surface, check the fluid level in the transmission.

1. Clean the area around the fill plug, and remove it from the side of the case.
2. Using your finger or a bent pipe cleaner, see if the fluid is level with the fill opening. See **Fig. 8**.
3. If the transmission fluid level is low, check the transmission for leaks, and correct as needed.
4. If needed, add the recommended fluid, until it is level with the lower edge of the fill opening. See **Table 2** for approved transmission lubricants.
5. Clean the fill plug, install it in the transmission, then tighten it 50 lbf·ft (68 N·m).

Meritor Transmission

CAUTION

Operating a transmission with the fluid level higher or lower than recommended can result in transmission damage. Do not overfill the transmission.

Do not mix types and brands of fluid, because of possible incompatibility. Do not use fluid additives, friction modifiers, extreme-pressure gear fluids, or multiviscosity lubricants.

1. Remove the fill plug from the transmission.
2. Insert a finger or pipe cleaner into the transmission.
3. Check that the fluid level is even with the base of the fill plug. See **Fig. 8**.

The correct fluid capacity is established by the fill opening. If the transmission has two fill plugs, check that the fluid level is consistent at both fill plugs.

4. If the transmission fluid level is low, check the transmission for leaks, and correct as needed.
5. If needed, add the recommended fluid, until it is level with the lower edge of the fill opening. See **Table 2** for approved transmission lubricants.

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Fifth Wheel Inspecting	31–01
Fifth Wheel Lubricating	31–02
Frame Fastener Torque Checking	31–03
Holland Fifth Wheel Sliding Mechanism Inspecting	31–04
Trailer Electrical Connector Lubricating	31–05

31–01 Fifth Wheel Inspecting

⚠ WARNING

All fifth wheel maintenance, adjustment, and rebuilding must be done only by a qualified mechanic. Improper or incomplete procedures could result in a possible disengagement of the trailer from the tractor, which could result in personal injury or property damage.

Parts are under spring compression. Wear safety goggles while servicing the fifth wheel. Failure to do so can result in personal injury, due to parts ejecting with force.

Fontaine

1. Disconnect the tractor from the trailer. For instructions, see the vehicle driver's manual.
2. Thoroughly steam clean the fifth wheel.
3. Look for cracks in the fifth wheel assembly, mounting brackets, and mounting parts.
4. Check the jaw and stationary jaw for mushrooming, and check that the serrations at the jaw and wedge are in good condition.
5. Test the safety lock latch for ease of operation.

NOTE: The safety lock latch is located at the front of the fifth wheel on the top plate.

6. Visually check for loose nuts or bolts (see **Fig. 1**) on the fifth wheel and on the mounting. Set a torque wrench to the maximum torque value for the bolt being checked, and confirm that the torque is to specification. Do not loosen the bolt to check the torque value. See **Group 00** of this manual for bolt torque specifications.
7. Visually check all springs to see if they are securely fastened, and are not deformed.

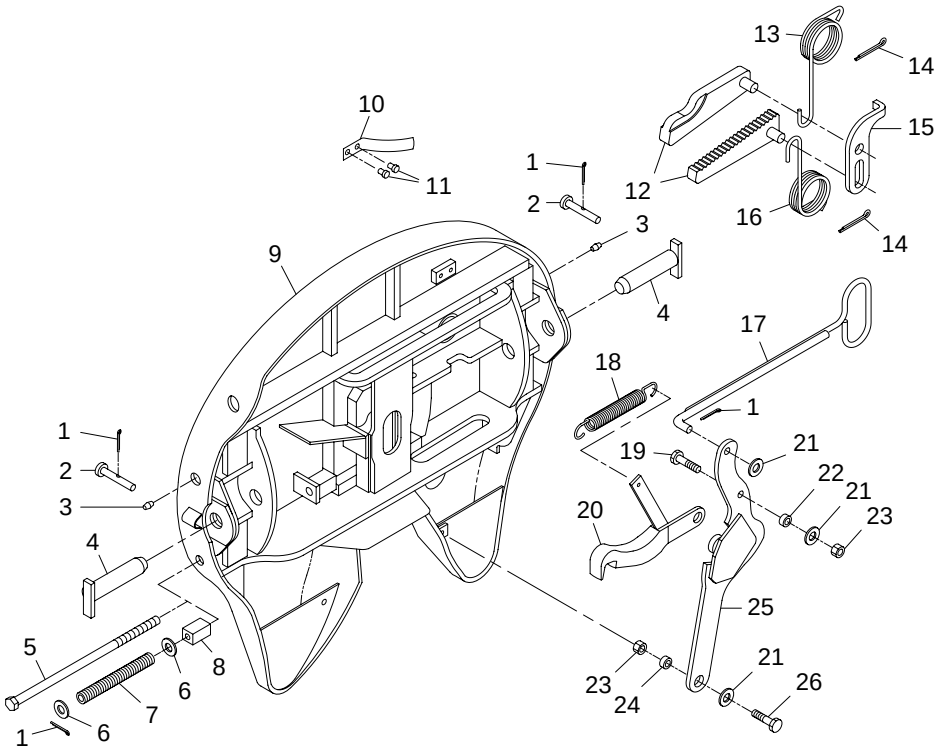
⚠ WARNING

Do not disassemble the fifth wheel to inspect the springs. The springs are under extreme pressure, and could cause serious injury.

8. Check wedge adjustment.
   - 8.1 Open the kingpin lock, and vertically insert a two-inch-diameter shaft.
   - 8.2 Release the lock by tripping the release latch at the bottom of the throat.
   - 8.3 Adjust the wedge stop at the end of the wedge to approximately 1/4-inch (6-mm) clearance by turning the wedge stop rod located on the right side of the top plate.
9. Replace cracked, worn, or damaged parts with new parts. Replace all loose mounting bolts with 5/8–11 SAE grade 8 bolts, grade C locknuts, and hardened washers. *Do not* re-use bolts, nuts, and washers on fifth wheel mountings.
10. After inspecting the fifth wheel, lubricate all moving parts with a chassis or multipurpose grease. Apply a generous coating of grease to the top plate to fill the grooves, or depressions, on the top plate. See **Maintenance Operation 31–02** for lubrication instructions.

Holland

1. Disconnect the tractor from the trailer. For instructions, see the vehicle driver's manual.
2. Thoroughly steam clean the fifth wheel.
3. Check for loose nuts or broken bolts on the fifth wheel assembly.
4. Inspect for cracks or wear on the mounting bolts.
5. Visually inspect for improper locking action and for cracks or wear on the jaw locking mechanism.
6. Check the depth of the grease grooves. If the depth of the grooves is 1/8 inch or less, replace the fifth wheel top plate. See **Group 31** of the *Heavy-Duty Trucks Service Manual*.
7. Check the condition of the X-pattern cast into the underside of the fifth wheel top plate. See **Fig. 2**. The fifth wheel top plate must be removed to check the X-pattern.
   - 7.1 Remove the roll pins from the bushing pins. Remove the bushing pins from the slide mount. Using a hoist, lift the fifth wheel top plate off of the vehicle.
   - 7.2 Turn the fifth wheel top plate over with the locks open. Check the condition of the X-pattern in the pockets. If the X-pattern is worn away, replace the fifth wheel top plate.



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1. 3/16 x 1 Cotter Pin
2. Lower Bracket Retainer Pin
3. Grease Fitting
4. Lower Bracket Pin
5. Wedge Stop Rod
6. Flatwasher
7. Wedge Stop Rod Spring
8. Wedge Stop Rod Nut
9. Side Release Upper Assembly
10. Leaf Spring
11. 1/4–20 x 3/8 Thread-Cutting Screw
12. Step Jaw and Wedge
13. Jaw Spring
14. 1/4 x 3 Cotter Pin
15. Timer
16. Wedge Spring
17. Pull Handle
18. Bumper Handle Spring
19. 1/2–13 x 2 Bumper Pivot Bolt
20. Bumper
21. Flatwasher
22. 5/16" Bumper Pivot Bushing
23. 1/2–13 Locknut
24. 7/16" Handle Pivot Bushing
25. Operating Handle (side-release only)
26. 1/2–13 x 2 Handle Pivot Bolt

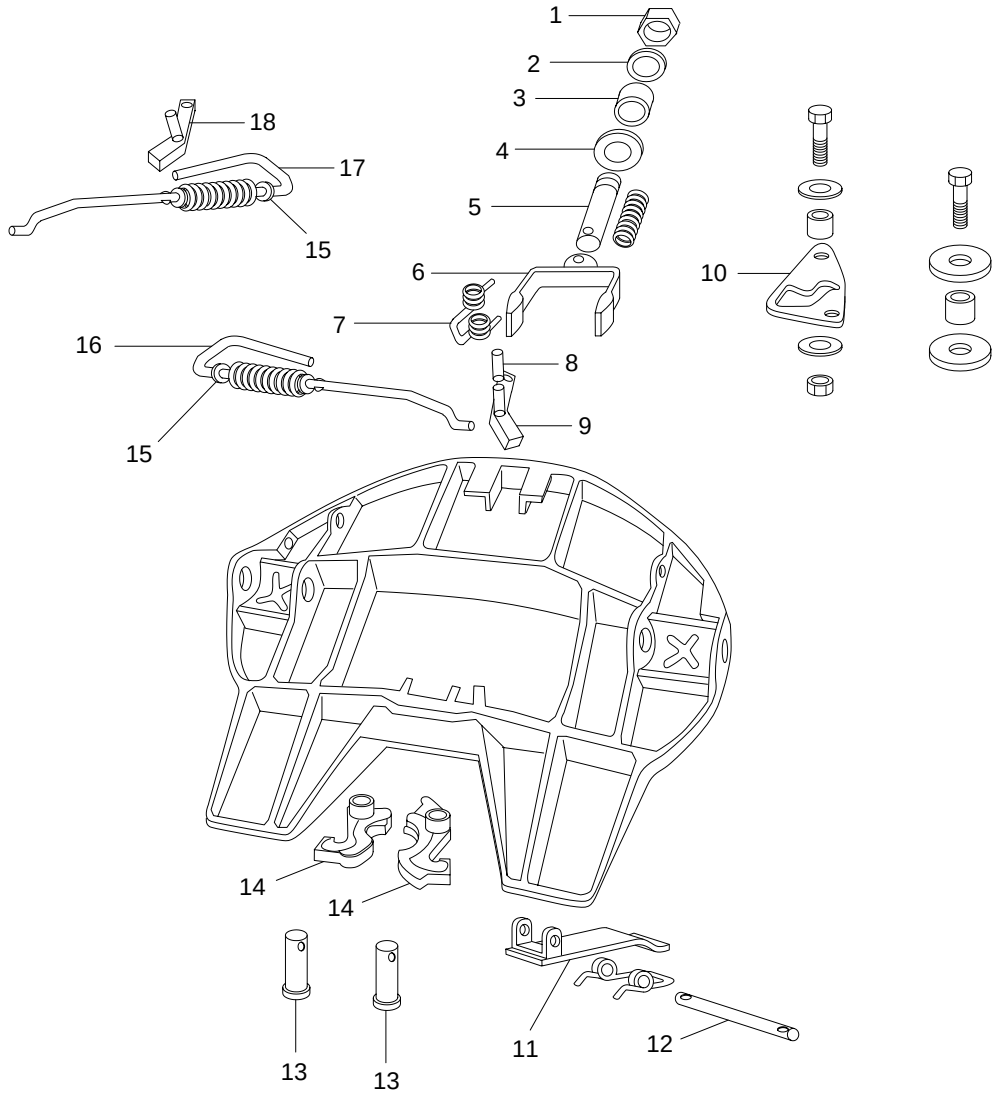
Fig. 1, Fontaine H5092 Series Fifth Wheel (left-side-release shown)

7.3 Install the fifth wheel top plate, bushing pins, and roll pins.

8. Inspect for fatigue or cracked welds.
9. Replace cracked, worn, or damaged parts with new parts. Replace all loose mounting bolts with 5/8–11 SAE grade 8 bolts, grade C locknuts, and hardened washers. *Do not* re-use bolts, nuts, and washers on fifth wheel mountings.
10. After inspecting the fifth wheel, lubricate all moving parts with a chassis or multipurpose grease. See **Maintenance Operation 31–02** for lubrication instructions.

Castloc II and Simplex Series

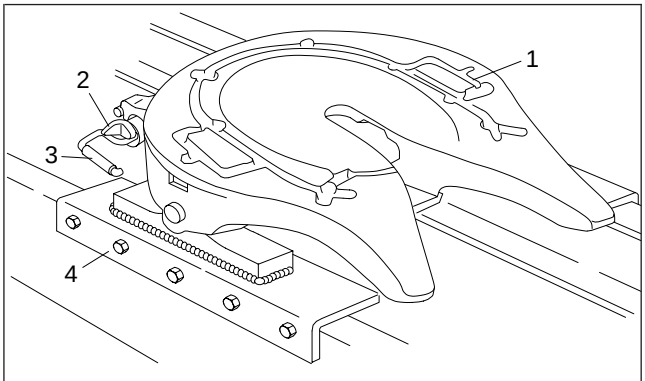
1. Disconnect the tractor from the trailer. For instructions, see the vehicle driver's manual.
2. Thoroughly steam clean the fifth wheel.
3. Check the fifth wheel plate for cracks. Check for sharp edges on top; the chamfer should be 1/8 to 1/4 inch (3 to 6 mm).
4. When the wheel is locked, the safety latch must swing free and fall freely into position. See **Fig. 3**.



1. Locknut, 3/4–16
2. Washer
3. Rubber Washer
4. Lock Adjustment Tag
5. Yoke Shaft
6. Yoke Sub-Assembly
7. Torsion Spring
8. Roll Pin
9. Secondary Lock, Right-Hand
10. Cam Plate
11. Lock Guard
12. Pin
13. Lock Pin
14. Lock Jaw
15. Washer
16. Right-Hand Release Handle
17. Left-Hand Release Handle
18. Secondary Lock, Left-Hand

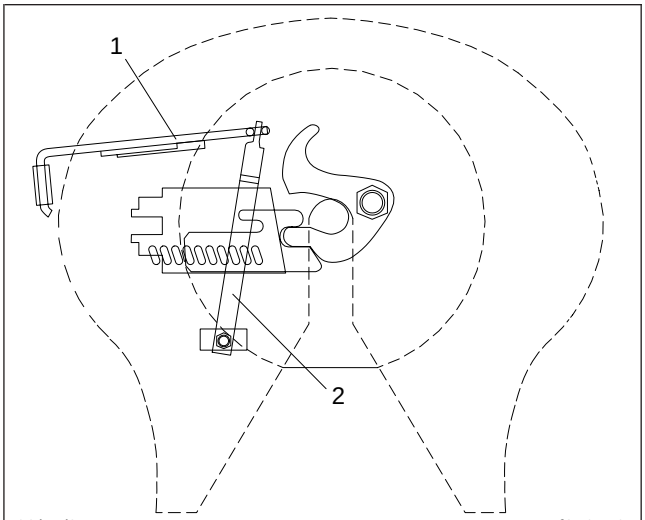
Fig. 2, Holland Fifth Wheel

5. The lever bar and operating handle must be in proper alignment. See **Fig. 4**. Compare the lever bar and operating handle alignment to a new, or a properly operating lever bar and operating handle. Replace any bent or misaligned lever bar or operating rod.
6. Check all cotter pins for cracking or damage. Replace any cotter pin that shows any signs of damage.
7. Level the fifth wheel plate to a horizontal position. Measure the height from a stationary mounting point (see **Fig. 5**, Ref. 3), such as the



1. Lubricant Grooves
2. Safety Latch
3. Lock Control Handle
4. Mount

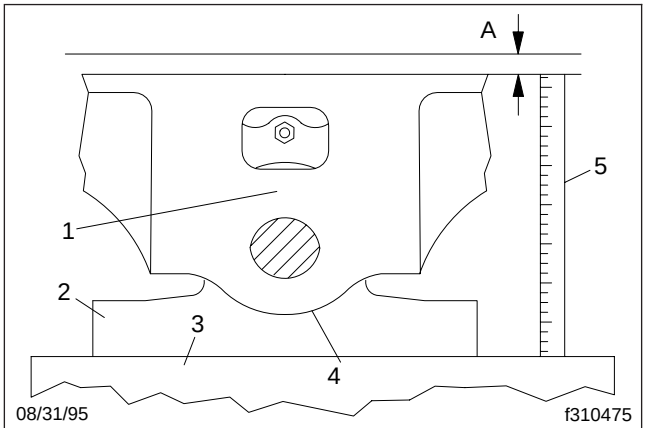
Fig. 3, Simplex Series Fifth Wheel



1. Operating Handle
2. Lever Bar

Fig. 4, Lever Bar and Operating Handle Alignment

frame rail to the top of the fifth wheel plate (Ref. 1). Pry up on the fifth wheel plate (Ref. 4) below the pin boss, and measure the vertical movement (Ref. 5). The bracket connection provides a 9/32-inch (7-mm) vertical clearance to provide cushioning and to avoid downward pin-loading while retaining minimum plate lift. If the plate lift (Ref. A) exceeds 5/16 inch (8 mm) as a result of wear or rubber deterioration, install new, standard or oversized bracket-shoe rubber pads; see **Group 31** of the *Heavy-Duty Trucks Service Manual* for replacement instructions.



A. Extended Top Plate Lift Height
1. Fifth Wheel Top Plate
2. Fifth Wheel Frame Mount
3. Frame Rail
4. Lifting Point
5. Static Top Plate Height

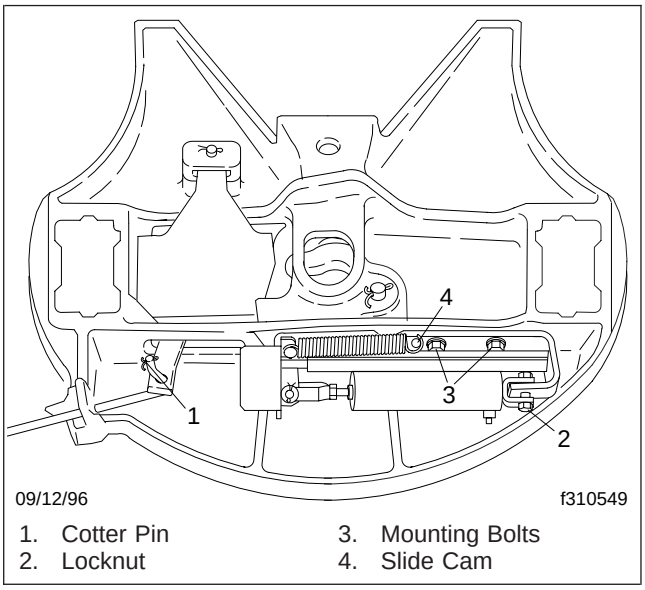
Fig. 5, Measuring Fifth Wheel Top Plate Lift

NOTE: Do not measure plate lift immediately after a trailer has been uncoupled from the fifth wheel. The rubber may have taken a temporary set, which will normally recover after being uncoupled for a short period of time.

8. Check all mounting bolts for signs of fatigue, and tighten them to the proper torque. For torque specifications, see **Group 00** of this manual. Inspect all angles, plates, and brackets for cracks or other damage.
9. Replace cracked, worn, or damaged parts with new parts. Replace all loose mounting bolts with 5/8–11 SAE grade 8 bolts, grade C locknuts, and hardened washers. *Do not* re-use bolts, nuts, and washers on fifth wheel mountings.
10. After inspecting the fifth wheel, lubricate all moving parts with a chassis or multipurpose grease. See **Maintenance Operation 31–02** for lubrication instructions.

ASF Touchloc™ Control Mechanism General Inspection

1. Replace cracked, broken, bent, or missing parts with new parts. See **Fig. 6**.
2. The cotter pin located in the slide cam clevis pin must be in place and properly spread.



1. Cotter Pin
2. Locknut
3. Mounting Bolts
4. Slide Cam

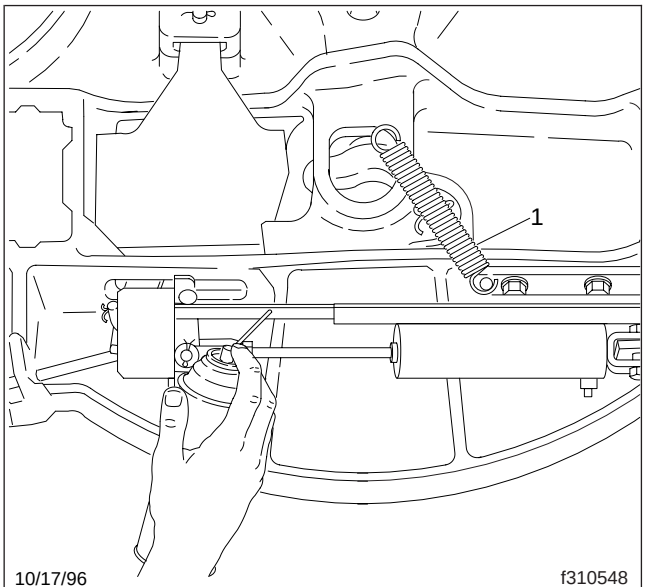
Fig. 6, Touchloc Control Mechanism General Inspection

3. The locknut that attaches the air cylinder to the housing weldment must be tight, but should not distort the cylinder clevis legs inward.
4. Check all mounting bolts for tightness.

NOTE: A sluggish slide cam may be improved by spraying the slide cam, track, and inside of the rectangular slide cam housing with a product such as light oil, silicon lube, or equivalent.

ASF Touchloc™ Control Mechanism Lubrication

1. With the air cylinder and the slide cam in the retracted position, lubricate the cam track with a light oil-type lubricant. See **Fig. 7**.
2. If the operating rod plate casting track is rusted, apply penetrating oil (with teflon) to remove the rust. Apply white lithium grease into the track.
3. Remove the extension spring for easy access.
4. Activate the cab control valve, moving the operating rod into lockset (unlocked mode) position.
5. Lubricate the slide cam shaft.
6. Spray lubricant into the rectangular slide cam housing.
7. Replace the extension spring.



1. Extension Spring

Fig. 7, Touchloc Control Mechanism Lubrication

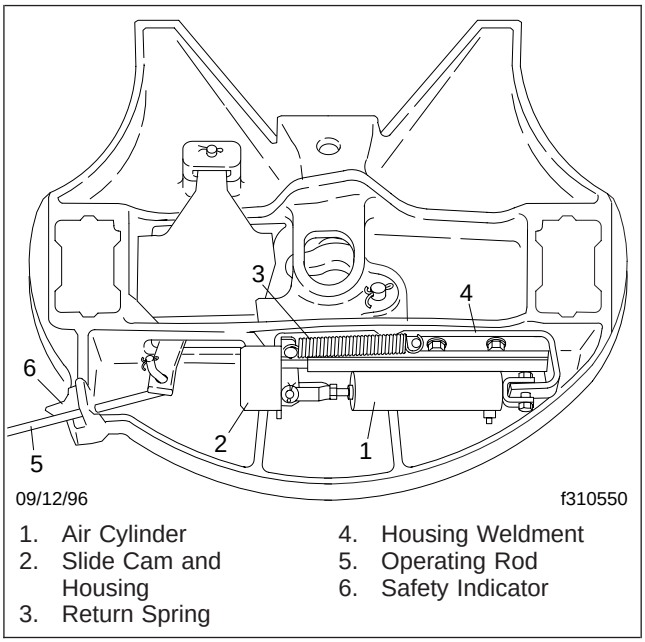
8. Cycle the slide cam several times to ensure smooth operation.
9. Lubricate the air mechanism unit each time the tractor is steam cleaned.

ASF Touchloc™ Control Mechanism Component Inspections

1. Thoroughly inspect the air cylinder (**Fig. 8**). It must retract and extend throughout the operating range without any interruption of piston travel.

   The air cylinder is in satisfactory working order upon completion of six consecutive extensions and retractions at 90 to 120 psi standard operating pressure.

   If the air cylinder does not function properly, remove the air cylinder. Manually extend the piston to its maximum length, and retract fully. Any binding of the piston requires reconditioning or replacement.
2. Inspect the slide cam and housing for any warpage, damage, or cracks. If any cracks are found, replace the components.
3. Check the return spring for overextension, abrasion, and a rust-deteriorating condition which would require replacement.



1. Air Cylinder
2. Slide Cam and Housing
3. Return Spring
4. Housing Weldment
5. Operating Rod
6. Safety Indicator

Fig. 8, Touchloc Control Mechanism Component Inspection

4. Inspect the housing weldment for cracks, warpage, or damage. If cracks are found, replace the component.
5. Inspect the operating rod for cracks, warpage, or damage. If cracks are found, replace the component.
6. Check the safety indicator for proper function. When the air mechanism unit is activated, the operating rod is forced into the lockset position and the safety latch will rotate toward the rear.
7. Check the exhaust seat and inlet valve seat for nicks or burrs. Inspect all rubber parts for signs of cuts, abrasion, swelling, or deterioration. Replace as necessary.

ASF Touchloc™ Control Mechanism System Operation Check

1. Park the vehicle and chock the tires.
2. **With the parking brake not set**, pull the Touchloc control valve. The air cylinder **should not activate** the air mechanism unit.
    - If the air cylinder is activated, check the inversion and the cab control valves for proper operation.
    - Replace malfunctioning valves.
    - After replacing the valves, recheck for proper system operation.
3. **With the parking brake set**, determine that the brakes have been applied. Pull the Touchloc control valve. The air cylinder **should activate** the air mechanism unit.
    - If the air cylinder does not function, check the inversion and cab control valves for proper operation.
    - Replace the malfunctioning valves.
    - After replacing the valves, recheck for proper system operation.

NOTE: Neither the vehicle nor the air mechanism system should be operated when the spring brake section is caged.

4. Remove the chocks from the tires.

31–02 Fifth Wheel Lubricating

To maintain proper fifth wheel operation, always lubricate the fifth wheel after an inspection has been performed.

IMPORTANT: Lubricate the fifth wheel:

- After power washing, or steam cleaning.
- If the vehicle operates in harsh conditions such as salt spray from road surfaces, or in extremely dusty environments.
- After any service that requires the removal of lubrication from the fifth wheel head or components.

⚠ WARNING

Failure to properly lubricate the fifth wheel could result in a possible disengagement of the trailer from the tractor, which could result in personal injury or property damage.

Fontaine

Use a multipurpose extreme pressure (EP) chassis grease, and lubricate all moving parts on the fifth wheel. When lubricating the top plate at the grease fittings for the bracket bearing area, tilt the top plate forward and backward to evenly distribute the

grease. Using a pry tool, separate the jaw and wedge and lubricate the serrations using a brush to distribute the grease. On slide-mount applications, lubricate the slide rail and tapered wedges for smooth operation.

Once the moving parts of the fifth wheel are lubricated, apply a liberal coating of grease to the top plate and the trailer kingpin plate.

Holland

Lubricate all moving parts with a multipurpose chassis grease. Lubricate, with a multipurpose chassis grease, the two grease fittings located on either side of the top plate.

Once the fifth wheel's moving parts are lubricated, apply a heavy coat of grease to the top plate by direct application. On slide-mount applications, lubricate the baseplate rails and the plungers for smooth operation.

Castloc II and Simplex Series

Use a chassis or multipurpose grease to lubricate the two grease fittings located on either side of the fifth wheel top plate. Lubricate the two grease fittings located in the grease grooves on the fifth wheel top plate. Lubricate the two grease fittings located below the top plate mounting pins. Lubricate the lock mechanism.

Once the fifth wheel's moving parts are lubricated, apply a heavy coat of grease to the top plate, either through the grease fittings located on the underside of the top plate, or by direct application. On slide-mount applications, lubricate the slider lock pockets and the slider bracket.

31–03 Frame Fastener Torque Checking

Frame brackets and components secured with Huckbolt® fasteners do not require a torque check, however, they should be inspected for damage. Frame brackets and components secured with conventional bolts and nuts are to be checked at initial maintenance (IM). Check the torque of frame fasteners to offset the effects of "bedding in" (or seating). When checking torque, torque the nut, not the bolt head whenever possible. This will give a true torque reading by eliminating bolt body friction. When checking the torque of frame fasteners, inspect the frame for cracks and other damage. Set a click-type torque wrench to the maximum torque of the fastener you are checking. Apply pressure until the torque wrench clicks. Do not loosen the bolt to check the torque. See the applicable torque table in **Group 00** for torque specifications.

⚠ CAUTION

Make sure frame fasteners are properly tightened. Continued vehicle operation with loose fasteners could result in bracket or frame damage.

NOTE: Engine supports on vehicles built from January 2007 do not require checking.

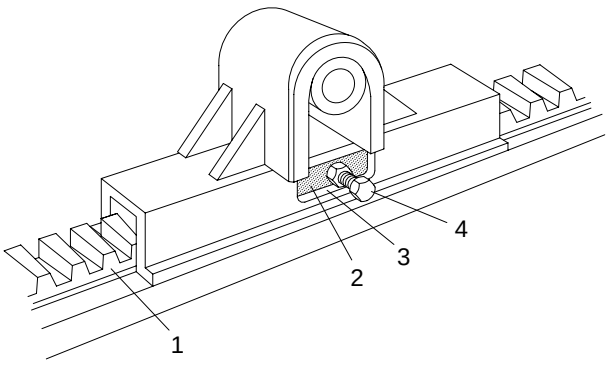
Inspect, and check the torque of the fasteners at these locations:

- Axle Stops
- Deck Plates
- Engine Trunnion Supports
- Equalizer Brackets
- Exhaust Brackets
- Fifth Wheel Legs
- Fifth Wheel Mountings
- Frame Crossmembers and Gussets
- Front Frame Brackets
- Front Suspension Spring Brackets
- Fuel Tank Brackets
- Radius Rods
- Rear Engine Supports
- Rear Suspension Spring Brackets
- Shock Absorbers
- All Other Frame Fasteners

Any component that shows signs of cracking or other damage, must be repaired or replaced. Refer to the *Heavy-Duty Trucks Service Manual* for repair or replacement information in the respective section for the component in question.

31–04 Holland Fifth Wheel Sliding Mechanism Inspecting

1. Loosen the locking plunger jam nut and turn the adjusting bolt out (counterclockwise). See **Fig. 9**.



1. Rack
2. Plunger
3. Pocket
4. Plunger Adjusting Bolt

Fig. 9, Locking Plungers

2. Disengage and engage the locking plungers. Check that the plungers are securely seated without binding. If the locking plungers do not operate properly, see **Group 31** of the *Heavy-Duty Trucks Service Manual* for adjustment procedures.
3. Turn the adjusting bolt in (clockwise) until it contacts the rack. Turn the adjusting bolt an additional 1/2 turn, then securely tighten the locking nut.

31–05 Trailer Electrical Connector Lubricating

In some cases, failure of trailer cables occurs due to intrusion of chloride-based road deicing chemicals into the trailer connector. Once inside the connector, the chloride-based chemicals corrode the brass terminals and create bridging between positive and ground terminals.

NOTE: The use of soap is not recommended for cleaning the electrical connector, as some soaps may increase the corrosion process.

1. Wash out any existing grease, dirt, and corrosion on the trailer connectors with electrical contact cleaner spray.
2. Grease the trailer connector with a lithium-based dielectric grease.

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Suspension Inspecting	32–01
Suspension Lubricating	32–02
Suspension U-Bolt Torque Checking	32–03

32–01 Suspension Inspecting

Front Suspension Check

⚠ WARNING

Do not replace individual leaves of a damaged leaf spring assembly; replace the complete spring assembly. Visible damage (cracks or breaks) to one leaf causes hidden damage to other leaves. Replacement of only the visibly damaged part(s) is no assurance that the spring is safe. On front spring assemblies, if cracks or breaks exist in the two top leaves, a loss of vehicle control could occur. Failure to replace a damaged spring assembly could cause an accident resulting in property damage, serious personal injury, or death.

Inspect the front spring assemblies for cracked, broken, or abnormally bent leaves. If any of these conditions exist, replace the spring assembly. See **Group 32** of the *Heavy-Duty Trucks Service Manual* for instructions.

Front and Rear Suspension Shock Absorber Check

Make sure the shock absorber brackets are tight, and the shock absorber is not striking or rubbing the frame or some other part of the chassis. Striking or rubbing the frame is characterized by chafe marks on the shock absorber body and the frame rail. See **Fig. 1**. Check the rubber mounting bushings for cracks, cuts, swelling, and dry rot. Also, check the bushings for missing pieces. Replace the bushings as needed.

Inspect the shock absorber for oil leakage. If the shock absorber is damaged or leaking, replace it with a new one. See **Group 32** of the *Heavy-Duty Trucks Service Manual* for replacement instructions.

Rear Suspension Check

Freightliner Spring Suspension

⚠ WARNING

Do not replace individual leaves of a damaged leaf spring assembly; replace the complete spring assembly. Visible damage (cracks or breaks) to one leaf causes hidden damage to other leaves. Replacement of only visibly damaged parts is no assurance that the spring is safe. Failure to replace a damaged spring assembly could cause an accident, resulting in serious personal injury or property damage.

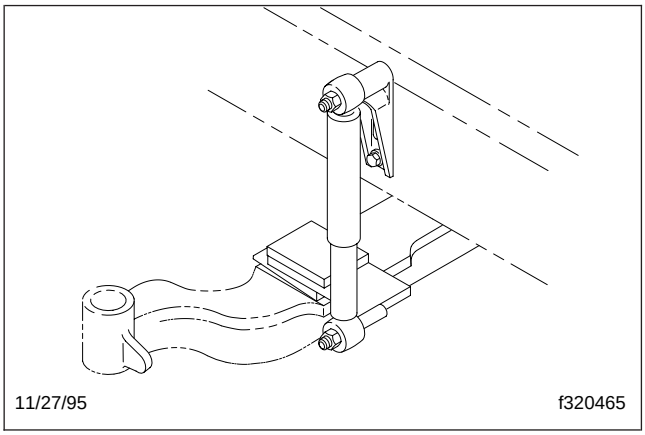


Fig. 1, Direct-Acting Shock Absorber (front suspension shown)

Replace worn, cracked, or damaged spring brackets. Failure to do so could result in bracket breakage, possibly leading to loss of vehicle control and resulting in personal injury or property damage.

1. Inspect the forward and rear spring brackets and equalizer brackets for loose fasteners, wear, cracks, and other damage. If any of these conditions exist, replace the damaged bracket(s). See **Group 32** of the *Heavy-Duty Trucks Service Manual* for instructions.
2. Inspect the tandem-axle frame crossmember and gussets for loose fasteners, wear, cracks, and other damage. If any of these conditions exist, replace the damaged parts. See **Group 32** of the *Heavy-Duty Trucks Service Manual* for instructions.

NOTICE

Failure to replace the suspension crossmember or gussets if they are cracked, worn, or otherwise damaged could result in damage to the vehicle chassis.

3. Without detaching the torque arms, attempt to move (by hand) each radius-rod end up, down, in, and out. If there is any movement, replace the torque arm. If a torque arm needs to be re-

placed, see **Group 32** of the *Heavy-Duty Trucks Service Manual* for instructions.

4. Inspect the weld seams between the torque arm tube and the shorter bushing tubes. If there are cracks, replace the torque arm. Do not weld the torque arm for any reason.
5. Inspect the rubber bushing ends. See **Fig. 2**. Replace the torque arm for any of the following reasons:
   - If there are gaps between the rubber bushing and the pin or outer steel sleeve.
   - If either bushing end contacts a torque arm pin mounting bolt.
   - If there are cracks in the bushing.
   - If part of the rubber bushing extends beyond the outer circumference of the outer bushing sleeve.
6. Block up the frame enough to take chassis weight off the springs. Attempt to move the equalizer up and down, using a pry bar between the top of the equalizer and top of the equalizer bracket; apply hand pressure only. See **Fig. 3**. If movement at the center of the equalizer exceeds 1/8 inch (3 mm), replace the equalizer bushings. See **Group 32** of the *Heavy-Duty Trucks Service Manual* for instructions.
7. With the vehicle unloaded, attempt to move the equalizer side to side, using a pry bar between the equalizer and frame rail. Apply hand pressure only. See **Fig. 4**. If clearance between the equalizer assembly and any frame component or fastener is less than 1/8 inch (3 mm), replace the equalizer bushings. See **Group 32** of the *Heavy-Duty Trucks Service Manual* for instructions.

Hendrickson Spring/Walking Beam Suspension, Models RT, RTE, and RTEA

1. Inspect the suspension assembly for loose fasteners, wear, cracks, and damage to its components. Replace the component(s) if any wear, cracks, or damage exist. If any of these conditions exist, replace the damaged bracket(s). See **Group 32** of the *Heavy-Duty Trucks Service Manual* for instructions.

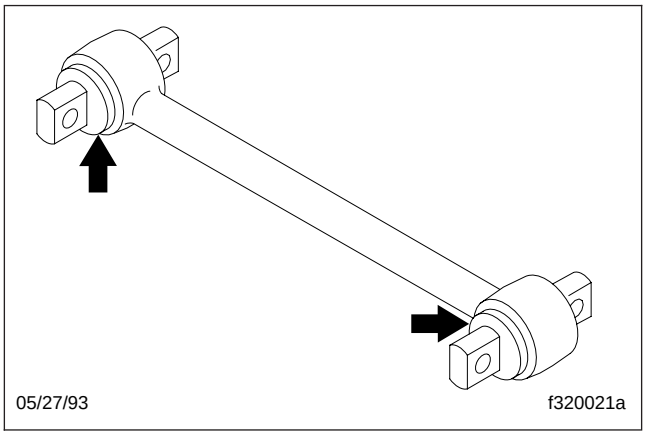
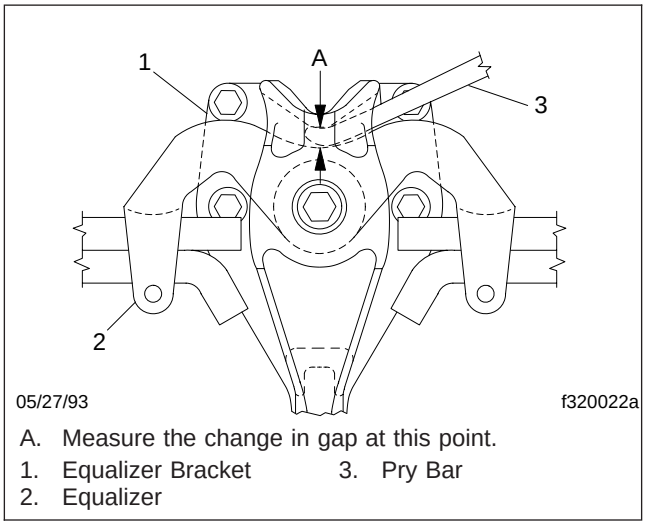


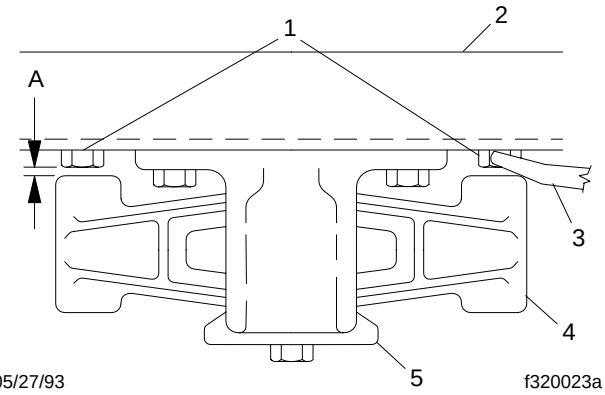
Fig. 2, Torque Arm Bushings



A. Measure the change in gap at this point.
1. Equalizer Bracket
2. Equalizer
3. Pry Bar

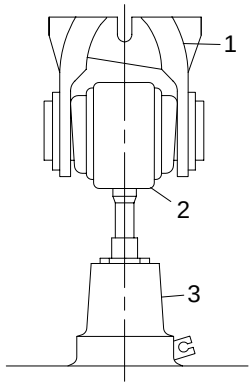
Fig. 3, Side View of the Equalizer

2. Check for distorted or frayed rubber at the beam end bushings. If the bushings are damaged, replace them.
3. Check that the ends of the equalizer beam are not lower in the beam hanger. If the equalizer beam ends appear lower, use a jack to raise each beam end, and check for movement of the inner metal of the rubber end bushing. See **Fig. 5**. Movement cannot be corrected by tightening the fastener, because parts could be damaged. If there is movement, replace the rubber end bushings and all connecting parts. See **Group 32** of the *Heavy-Duty Trucks Service Manual* for instructions.



A. 1/8" (3 mm) Clearance
1. Frame Fasteners
2. Frame Rail
3. Pry Bar
4. Equalizer
5. Equalizer Bracket

Fig. 4, Top View of the Equalizer



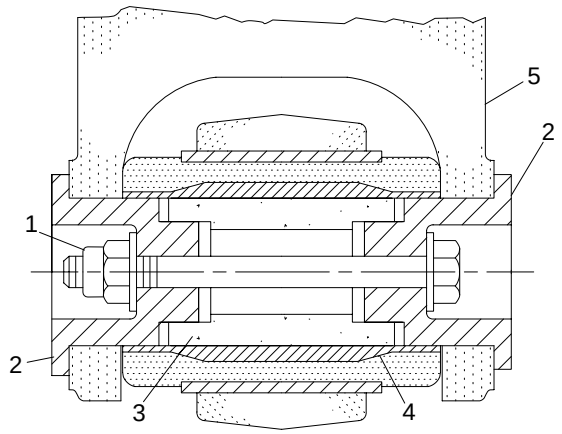
1. Beam Hanger
2. Equalizer Beam
3. Jack

Fig. 5, Raising the Hendrickson Suspension Beam End

⚠ WARNING

Insufficient beam end fastener torque could cause the beam to separate from the axle. This will cause loss of vehicle control resulting in property damage, serious personal injury or death.

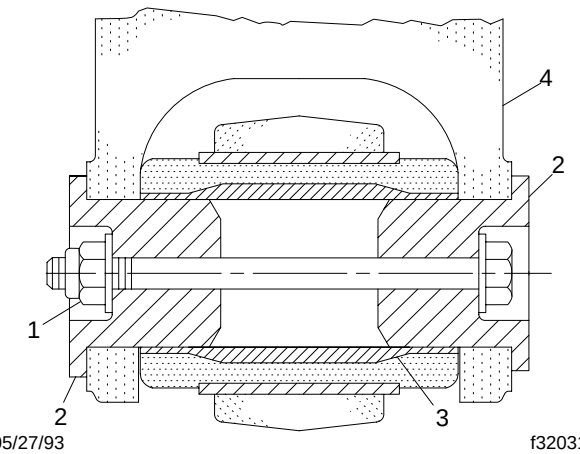
4. *After repairs to the suspension,* check the fastener torque after the vehicle has been in service for 2500 miles (4000 km). If equipped with the adapter-type beam end connection (see **Fig. 6** for the three-piece adapter-type beam end connection, or **Fig. 7** for the two-piece adapter-type beam end connection), tighten the nut 210 to 240 lbf·ft (285 to 325 N·m). If equipped with the tube-type beam end connection (see **Fig. 8**), tighten the nut 375 to 425 lbf·ft (508 to 576 N·m). Do not overtorque.



NOTE: Do not use the three-piece adapter without the intermediate tube.

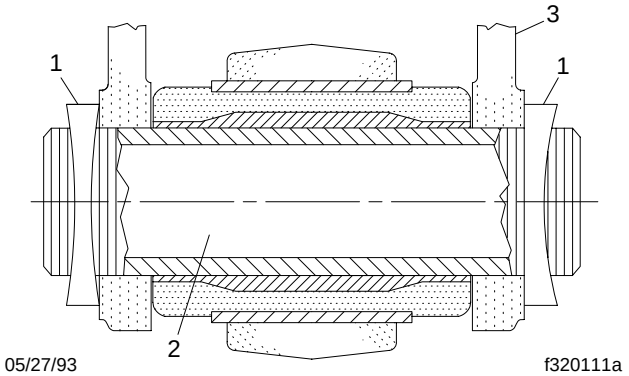
1. Nut
2. Adapter
3. Intermediate Tube
4. Inner Metal of Beam End Bushing
5. Beam Hanger

Fig. 6, Three-Piece Adapter-Type Beam End Connection



1. Nut
2. Adapter
3. Inner Metal of Beam End Bushing
4. Beam Hanger

Fig. 7, Two-Piece Adapter-Type Beam End Connection



1. Nut
2. End Tube
3. Beam Hanger

Fig. 8, Tube-Type Beam End Connection

5. Without detaching the torque arms, attempt to move (by hand) each radius-rod end up, down, in, and out. If there is any movement, replace the torque arm. If a torque arm needs to be replaced, see **Group 32** of the *Heavy-Duty Trucks Service Manual* for instructions.
6. Inspect the rubber bushing ends. Replace the torque arm for any of the following reasons:
   - If there are gaps between the rubber bushing and the pin or outer steel sleeve.
   - If either bushing end contacts a torque arm pin mounting bolt.
   - If there are cracks in the bushing.
   - If part of the rubber bushing extends beyond the outer circumference of the outer bushing sleeve.

Freightliner AirLiner Air Suspension

IMPORTANT: Before checking the AirLiner suspension height, make sure there is no load on the chassis, and the trailer is unhitched.

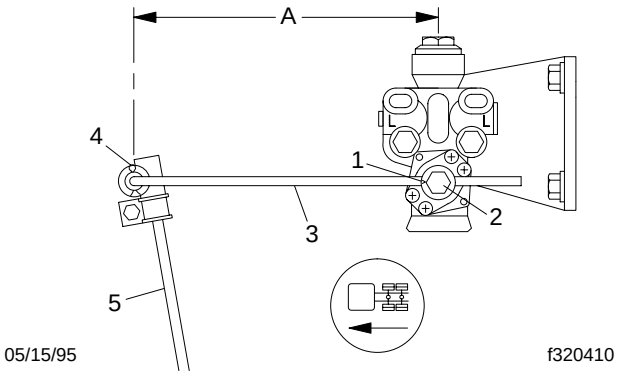
IMPORTANT: To prevent voiding the warranty on Barksdale height-control valves, note the following:

- Do not overtighten the bolts in the Barksdale height-control valve housing. The bolts should not be loose, and should not require tightening. Only if necessary, tighten the valve housing bolts 45 lbf·in (500 N·cm). Any damage to the valve housing will void the warranty.
- Do not attempt to disassemble the Barksdale valve body or the control lever. There are no serviceable parts in the valve, and any disassembly will void the warranty.

NOTICE

When removing or loosening a Barksdale height-control valve from a mounting bracket, always hold the valve-side mounting studs in place with an Allen wrench while loosening or tightening the nuts that attach the valve to the bracket. Because the mounting studs are threaded into the valve body, loosening the nuts without holding the studs can tighten the studs, which can crush the valve body and damage the valve. Conversely, tightening the nuts without holding the studs can back the studs out, causing a separation of the two halves of the valve body, and possibly a leak.

1. Park the vehicle on a level surface, using a light application of the brakes. Do not apply the parking brakes. Shift the transmission into neutral, and build the secondary air pressure to at least 100 psi (690 kPa). Shut down the engine.
2. Mark the location of the front and rear tires on the floor, and chock the tires on one axle only.
3. Check that the air line support brackets are positioned so the air lines do not rub against anything. Reposition any configurations that could contact and result in friction or wear. There must be at least 1 inch (25 mm) clearance around the rubber air spring when inflated. If clearance is less than 1 inch (25 mm), relocate the obstructing parts.
4. Check the length of the overtravel lever between its pivot points. See **Fig. 9**, Ref. A.
   - 4.1 If the vehicle is equipped with an adjustable leveling valve, the length should be 8 inches (203 mm). If the length is incorrect, see **Group 32** of the *Heavy-Duty Trucks Service Manual* for adjustment procedures.
   - 4.2 If the vehicle is equipped with a fixed leveling valve, see **Group 32** of the *Heavy-Duty Trucks Service Manual* for the overtravel lever length for the rear axle installed in your vehicle.

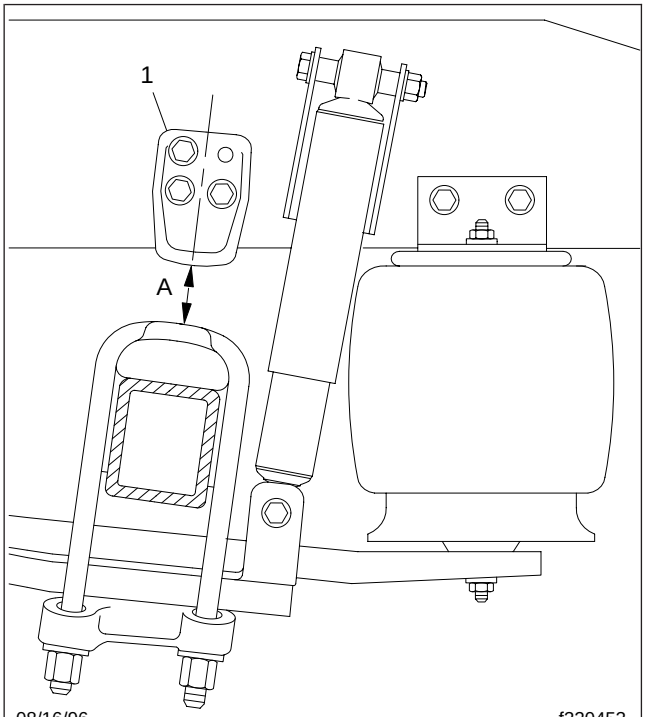


A. Measure the length of the overtravel lever between these two points.

1. V-Shaped Mark
2. Adjustment Locknut
3. Overtravel Lever
4. Cotter Pin
5. Linkage Rod

Fig. 9, AirLiner Overtravel Lever and Linkage Rod Measurement

5. On single-drive rear axle configurations, measure the distance from the bottom of the left axle stop to the top of the U-bolt pad. On tandem (dual-drive) rear axle configurations, measure the distance from the bottom of the forwardmost left axle stop to the top of the axle U-bolt pad. See **Fig. 10**, Ref. A. The correct distance for single and dual-drive rear axles is between 2-3/8 inches and 2-7/8 inches (60 to 73 mm).
6. If the axle stop measurement is not correct, see **Group 32** of the *Heavy-Duty Trucks Service Manual* for adjustment procedures.
7. Without detaching the control rods, attempt to move (by hand) each control-rod end up, down, in, and out. If there is any movement, examine the control rod for wear or damage. If a control rod needs to be replaced, see **Group 32** of the *Heavy-Duty Trucks Service Manual* for instructions.
8. Inspect the rubber bushings for cracks or cuts.
9. Check for any shifting of the barpin.
10. Inspect the weld seams between the control rod tube and the shorter bushing tubes. If there are cracks, replace the control rod. Do not weld the control rod for any reason.



A. Measure height here.

1. Left Forwardmost Axle Stop

Fig. 10, AirLiner Axle Stop Measurement

11. Raise the rear of the vehicle so the tires just clear the ground and the suspension is fully extended. Place safety stands under the vehicle frame.
12. Squeeze all air springs to check for complete deflation. If any air springs remain partially or fully inflated, see "Troubleshooting" in the appropriate section in **Group 32** of the *Heavy-Duty Trucks Service Manual*.
13. Inspect each air spring for wear at its connection to its pedestal. Replace any worn air springs; for instructions, see **Group 32** of the *Heavy-Duty Trucks Service Manual*.
14. Check the axle connection welds (beam-seat to equalizing-beam and axle-adapter to axle) for cracks. If welds are cracked, grind them out and reweld the parts.
15. Move the axle up and down while checking for signs of looseness due to worn parts at the front pivot connections. Replace any worn parts by

following the procedures in **Group 32** of the *Heavy-Duty Trucks Service Manual*.

16. Inspect the shock absorbers for oil leaks and worn rubber bushings. Replace the shock absorbers and/or rubber bushings if wear or damage is noted. For instructions, see **Group 32** of the *Heavy-Duty Trucks Service Manual*.
17. Remove the safety stands and lower the rear of the vehicle to the ground. Run the engine until air pressure of at least 100 psi (689 kPa) is maintained throughout the system.
18. Check that all air springs are inflated. If the air springs do not inflate, see **Group 32** of the *Heavy-Duty Trucks Service Manual* for possible causes and corrections.
19. Apply the parking brakes and remove the chocks.

Reyco 79KB and 179

Park the vehicle on level ground and chock the front tires to prevent the vehicle from moving. Place the transmission in neutral, and release the parking brakes.

1. Check that the torque rod clamps are directed away from the spring to prevent possible interference during operation. See **Fig. 11** for a Reyco 79KB, or **Fig. 12** for a Reyco 179.
2. Check the fit of springs to hangers to ensure good ride characteristics.
3. Check for elongated holes in the suspension components. See **Group 32** of the *Heavy-Duty Trucks Service Manual* for proper repair procedures.
4. Check bushing condition. Replace any bushing that is worn, cracked, dry-rotted, or otherwise damaged. See **Group 32** of the *Heavy-Duty Trucks Service Manual* for bushing removal and installation instructions.
5. Check tire condition. If abnormal wear is found, check and replace all worn or damaged components, and check suspension alignment. See **Group 32** of the *Heavy-Duty Trucks Service Manual* for component removal and installation procedures, and for suspension alignment instructions.
6. Inspect all suspension fasteners for proper torque values. See **Group 00** of this manual for proper bolt torque specifications.

Chalmers Walking Beam Suspension, 800 Series

Chock the front tires to prevent the vehicle from moving. Place the transmission in neutral, and release the parking brakes before inspecting the Chalmers rear suspension.

Power wash the Chalmers rear suspension, or clean it with a hard-bristle brush before performing a visual inspection.

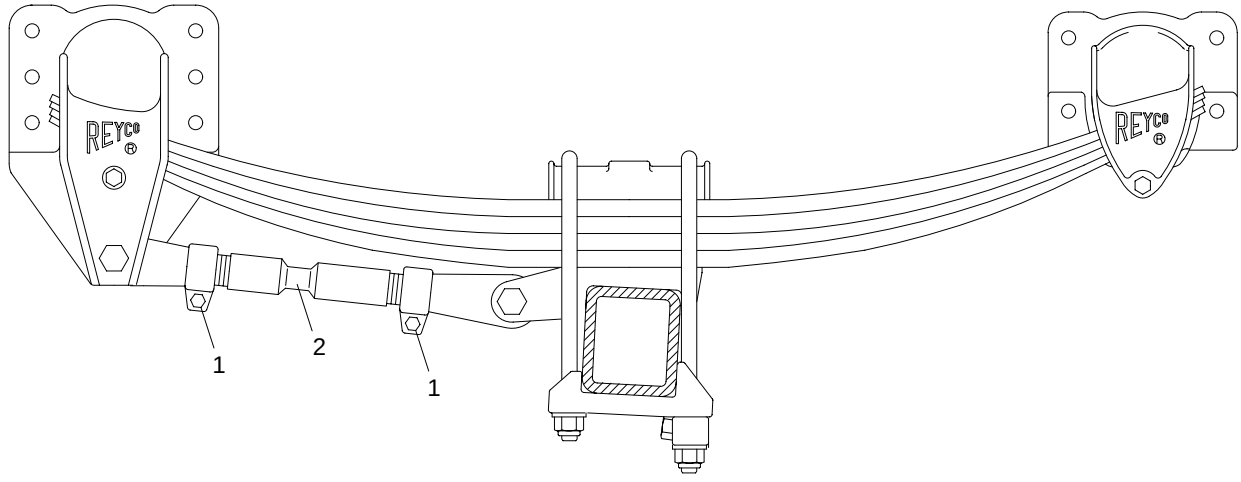
1. Visually inspect the rubber bushings for cracks or other damage.

   Try to move the torque rod ends using your hands only, and check for any free-play. If free-play is felt, replace the torque rod end bushing. Do not use a pry bar to check for free-play. Use of a pry bar may lead to premature bushing replacement.
2. Lift the rear of the vehicle and support the frame on jack stands to unload the suspension components. The vehicle is lifted high enough when the beam ends are off of the saddles. All jack stands must be of sufficient strength and rigidity to safely support the vehicle. Do not perform any work on or around a vehicle that is supported solely by a lifting device.

   Visually inspect the walking beam for cracks or other damage. If damage is found, replace the walking beam.

   Keep the vehicle supported by the jack stands for the next operation.
3. Manipulate the walking beam so that a micrometer, vernier, or dial caliper may be used to determine the wear area thickness on the bottom face. See **Fig. 13**. Measurements should be taken a minimum of 1/2 inch from the beam flange edges to eliminate any edge wear that may have occurred. Subtract the wear area thickness (**Fig. 13**, Ref. B) from the thickness at the non-wear area (**Fig. 13**, Ref. A) to determine the amount of wear.

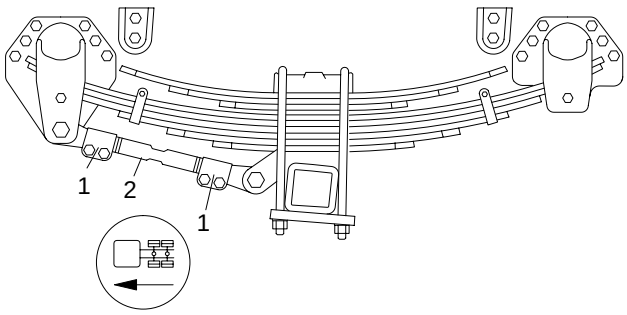
   If the beams show any wear greater than 0.062 inch (1.5 mm), a Chalmers wear plate must be installed, or the walking beam must be replaced.



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1. Torque Rod Clamp
2. Torque Rod

Fig. 11, Reyco 79KB Torque Rod Clamp Position



01/16/96 f320503

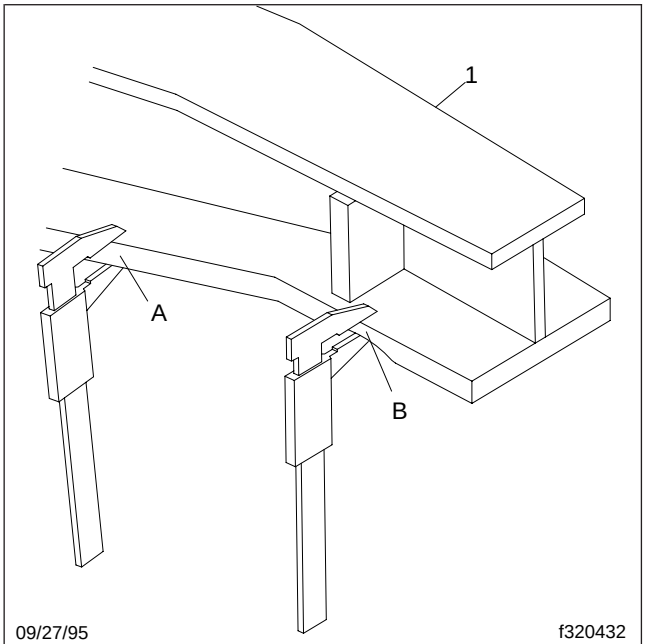
1. Torque Rod Clamp
2. Torque Rod

Fig. 12, Reyco 179 Torque Rod Clamp Position

4. Rotate the restrictor cans 360 degrees and visually inspect the cans for cracks, severe corrosion, and distortion. If any of these conditions are present, or the restrictor can is missing, replace the restrictor can.

⚠ WARNING

Replace all cracked or missing restrictor cans. Failure to do so could lead to loss of vehicle control, which could result in property damage, serious personal injury, or death. Vehicles with cracked or missing restrictor cans may be driven



09/27/95 f320432

A. Non-Wear Area
B. Wear Area
1. Walking Beam

Fig. 13, Walking Beam End Wear Thickness

slowly to the nearest workshop for restrictor can replacement.

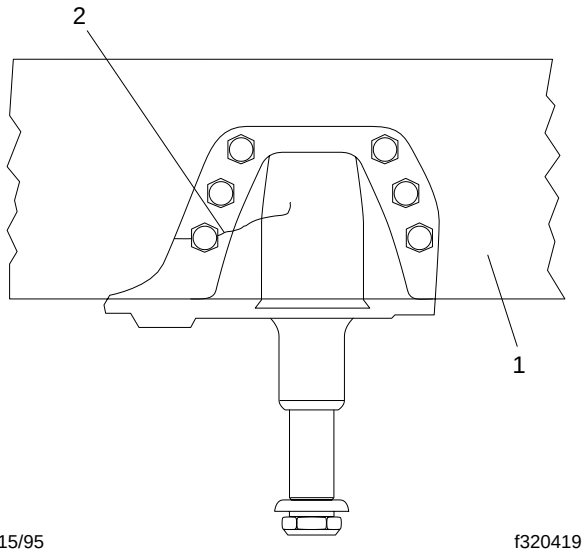
Hendrickson Walking Beam Suspension, RS Series

1. Inspect the frame hanger to frame attaching fasteners for the proper torque. See **Group 00** of this manual for torque specifications.

⚠ WARNING

Be sure that fasteners are torqued correctly. Fasteners that do not provide a tightly clamped joint between the frame and the hanger can cause premature fracture of the frame hanger, separation of components, loss of vehicle control, and possible personal injury or property damage.

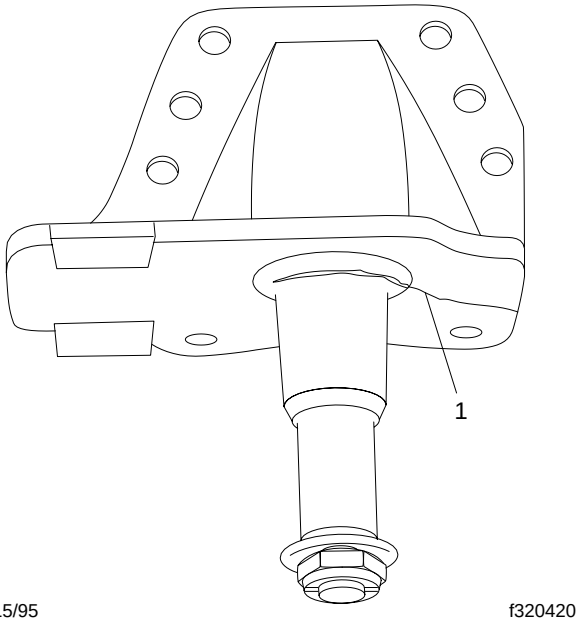
2. Visually inspect each frame hanger for any evidence of cracks in the vertical mounting flange. See **Fig. 14**.



1. Frame Rail
2. Crack in Inspection Area

Fig. 14, Hendrickson RS Series Vertical Mounting Flange

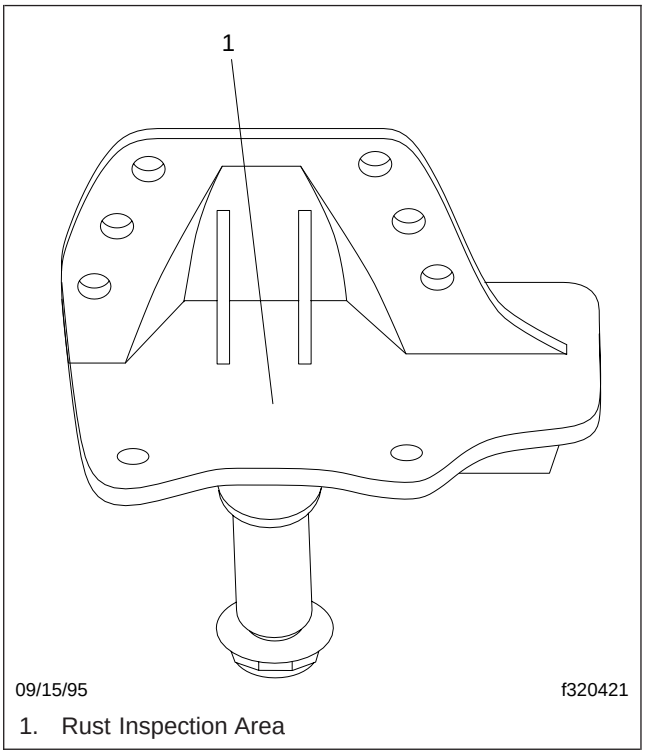
3. Visually inspect each frame hanger for evidence of cracks in the horizontal mounting flange adjacent to the vertical drive pin area. See **Fig. 15**.



1. Crack in Inspection Area

Fig. 15, Hendrickson RS Series Horizontal Mounting Flange

4. Visually inspect each frame hanger for severe rust on the horizontal mounting flange adjacent to the vertical drive pin area. See **Fig. 16**.
5. Inspect the load cushions for cuts and swelling. See **Fig. 17**. Cushions cut by the retaining lips of the saddles or frame hangers indicate the cushions may not be the correct hardness or configuration for the vehicle operation.
6. Inspect the lower side of the vertical drive bushings for evidence of torn or shredded rubber. Check that the concave washers are installed with the lips pointing downward.
7. Inspect the saddles and saddle cap fasteners for wear. The allowable thrust washer wear in aluminum saddles is up to 3/16 inch (4.8 mm) into the saddles as measured at the top of the thrust washer diameter. Check that the locknuts are torqued to specification to prevent wear of the beam center bushings into the legs of the saddles. See **Group 00** of this manual for torque specifications.



1. Rust Inspection Area

Fig. 16, Hendrickson RS Series Rust Inspection

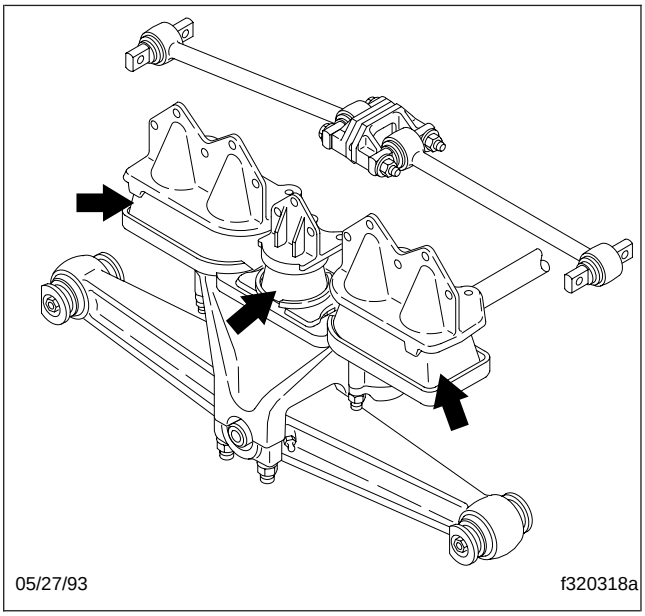


Fig. 17, Hendrickson RS Series Load Cushion Inspection

Hendrickson RT2 and RTE2 Series

1. Park the vehicle on a level surface, apply the parking brakes, and chock the front tires.

   Raise the rear of the vehicle until the rear wheels are suspended in the air, then support the vehicle with safety stands.

2. Check the torque of the number-one spring hanger (double-lock-bolt design) lock bolt nuts. If a loose connection has caused pin hole wear, replace the hanger.

3. Inspect the pin hole in the outboard leg of the number one spring hanger (draw-key design) for wear or elongation.

⚠ WARNING

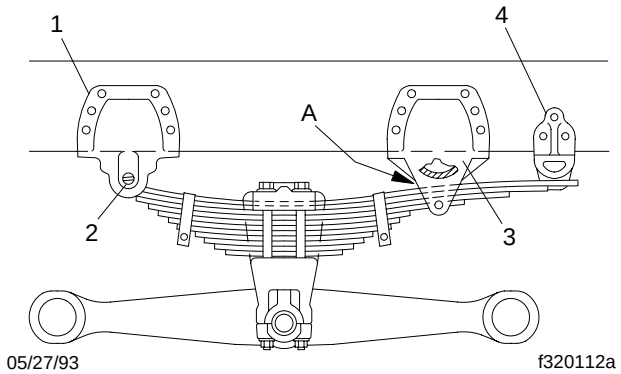
Wear at this point requires hanger replacement, or premature fracture of the spring hanger pin may occur, with possible separation of components and loss of vehicle control. This could result in serious personal injury or property damage.

4. Visually inspect the cam surface of the number-two spring hanger for wear due to operating mileage. Also, inspect the outside legs for wear which can be caused by worn spring eye bushings.

NOTE: RTE2 (extended-leaf-spring) suspensions require a minimum gap of 3/8 inch (9.5 mm) between the cam surface of the number-two spring hanger and the top of the main leaf in the unloaded condition. See **Fig. 18**. If this gap is less than 3/8 inch (9.5 mm), the extended-leaf portion of the spring will not perform satisfactorily for an empty ride.

5. Inspect the cam surface on the number-three spring hanger (extended-leaf-springs only) for wear. Excessive wear will reduce the gap available at the number-two spring hanger. Refer to the previous note.

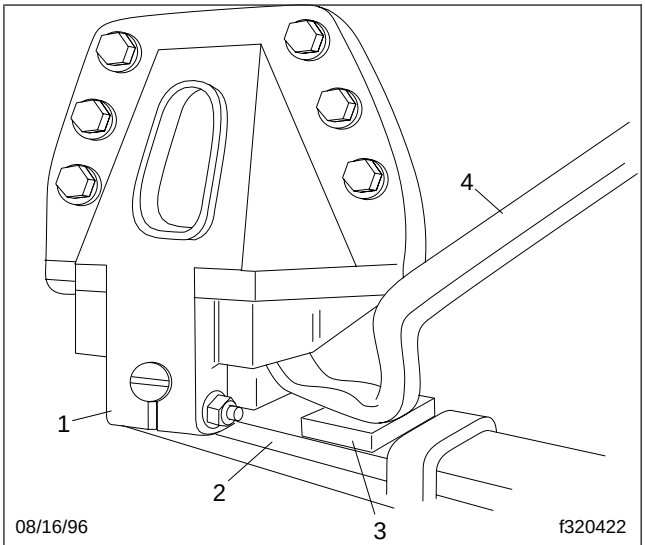
6. Place a block of wood on the leaf spring. See **Fig. 19**. Place a pry bar on the block of wood and insert the end of the pry bar under the frame hanger. Attempt to lift the frame hanger, as shown in **Fig. 19**. Also, with an empty chassis and the brakes applied, attempt to rock the chassis back and forth while observing the spring eye. In either case, if 1/8 inch or more of move-



A. Minimum gap of 3/8" (9.5 mm).
1. Forward (no. 1) Spring Hanger
2. Spring Eye Pin
3. Rear (no. 2) Spring Hanger
4. Rear (no. 3) Extension

Fig. 18, RTE Suspension (unloaded)

ment is observed, the bushing and pin should be replaced. This also could indicate that a broken spring eye and spring are connected to the spring hanger through the wrapper eye of the second leaf. In this case, the main leaf or the complete spring should be replaced immediately.



1. Frame Bracket
2. Leaf Spring
3. Wood Block
4. Pry Bar

Fig. 19, Hendrickson RT2 and RTE2 Series Frame Bracket Inspection

Neway

WARNING

Inspect the components and check their operation as described below. Failure to perform these inspections and checks could result in separation of worn suspension components and loss of vehicle control, possibly causing personal injury or death, or property damage.

1. Park the vehicle on a level surface. Apply the parking brakes and chock the tires to prevent the vehicle from moving.
2. Inspect the rear suspension for any signs of damage, loose components, wear, or cracks. Replace any damaged components to prevent failure or equipment breakdown.
3. Inspect all bolts and nuts at the pivot and axle connections to assure they are properly torqued. Check all other nuts and bolts for proper torque. See **Group 00** of this manual for proper torque specifications.
4. Check the air pressure gauge to confirm that there is in excess of 65 psi (448 kPa) in the air system, and inspect the air springs for sufficient and equal firmness.

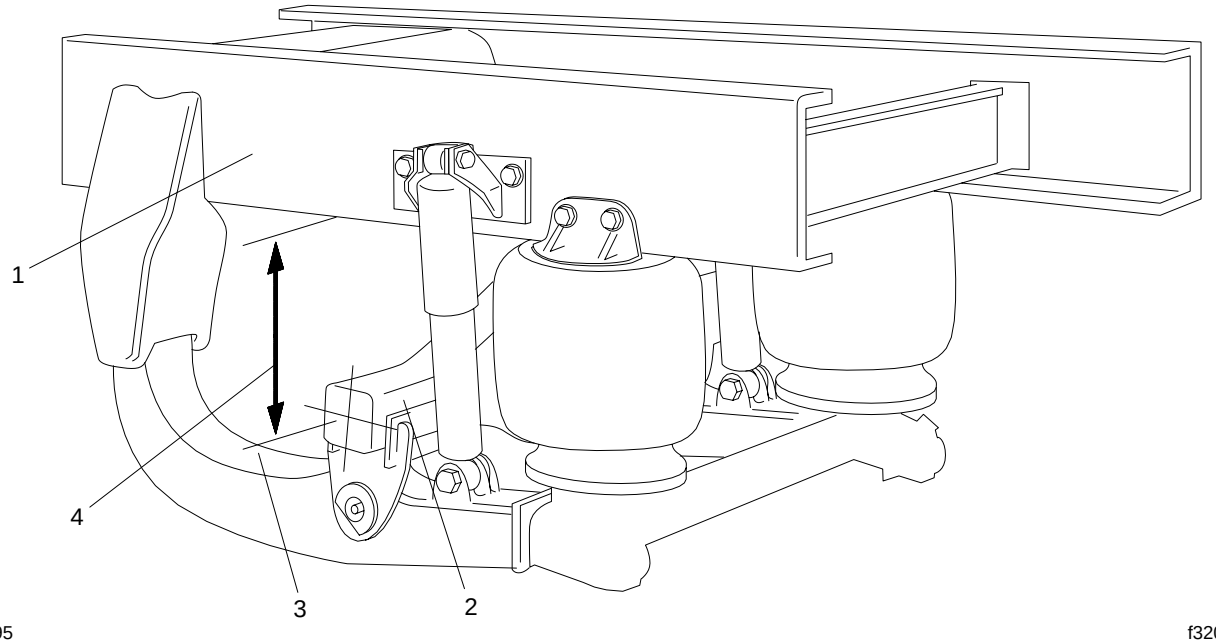
NOTE: Height control valves control all air springs. Check for air leaks by applying a soapy solution, then checking for bubbles, at all air connections and fittings.

5. Check the riding height of the air suspension by measuring the distance from the centerline of the rear axle (see **Fig. 20**) to the bottom of the frame rail. If the riding height is incorrect, adjust the air suspension.

32–02 Suspension Lubricating

Front Suspension

Wipe all dirt away from the grease fittings (if equipped) on the spring-eye bushings. Apply multipurpose chassis grease with a pressurized grease gun until the old grease is forced out.



1. Frame Rail
2. Axle Housing
3. Axle Centerline
4. Suspension Ride Height

Fig. 20, Neway Ride Height Inspection

Rear Suspension

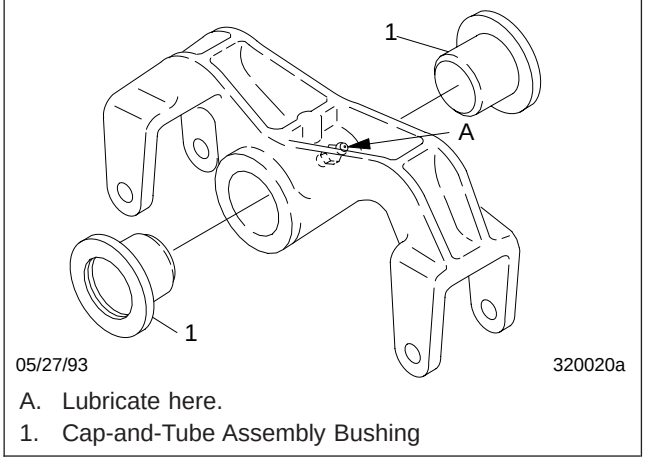
Freightliner Spring

Single Axle

No lubrication is required on Freightliner single axle rear suspensions.

Tandem Axle

Lubricate the equalizer cap-and-tube assembly bushings by applying multipurpose chassis grease at the grease fitting until the old grease is forced out from the cap-and-tube assembly. See **Fig. 21**.



A. Lubricate here.
1. Cap-and-Tube Assembly Bushing

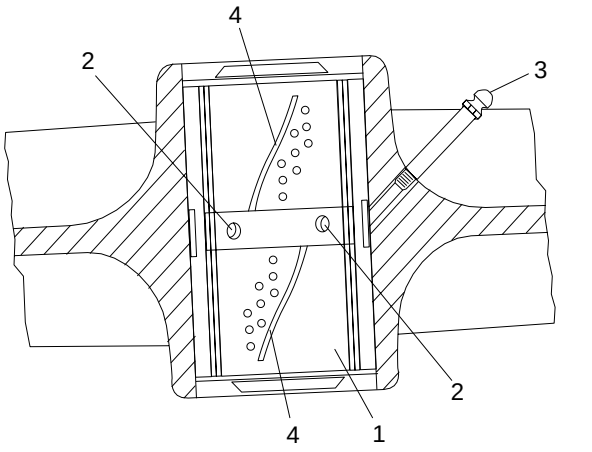
Fig. 21, Equalizer Assembly Lubrication

Hendrickson Spring Suspension, RT2 and RTE2 Series

Lubricate the bronze, ball-indented bushings in the spring eye, as follows:

1. Park the vehicle on a level surface, apply the parking brakes, and chock the front tires.
2. Raise the rear of the vehicle until the rear wheels are suspended in the air, then support the vehicle with safety stands. This relieves the load on the bushings and pins to allow the proper flow of lubricant around them.
3. Using a multipurpose chassis grease, lubricate the bronze, ball-indented bushings in the spring eyes at the grease fitting. See **Fig. 22**. Continue

to lubricate until grease exits both ends of the bushing. If the pin will not accept lubricant, remove the pin and clean the lubrication channels where lubricant may have hardened. Remove the safety stands and lower the vehicle after lubrication is complete.



1. Bronze Bushing
2. Lubrication Hole
3. Grease Fitting
4. Lubrication Groove

Fig. 22, Hendrickson RT2 and RTE2 Series Bushing Lubrication

Neway

No lubrication is required on Neway rear suspensions.

Reyco

No lubrication is required on Reyco rear suspensions.

Hendrickson Walking Beam, Series RS

No lubrication is required on RS Series suspensions equipped with rubber bushings.

If the equalizer beam has a bronze center bushing, apply multipurpose grease at the beam grease fitting on the equalizer beam center hub, until clean grease appears at both ends of the grease seals.

Chalmers Walking Beam

No lubrication is required on the Chalmers rear suspension.

32–03 Suspension U-Bolt Torque Checking

CAUTION

Failure to retorque the U-bolt nuts could result in spring breakage and abnormal tire wear.

1. Park the vehicle on a flat surface and apply the parking brakes. Chock the tires to prevent the vehicle from moving.
2. Check the U-bolt torque in a diagonal pattern. Set a click-type torque wrench to the highest torque value for the fastener being checked. See **Table 1** for U-bolt torque specifications. Turn the wrench in a clockwise motion (looking up) until the torque wrench clicks.
3. Remove the chocks.

U-Bolt Torque Values		
Description	**Size**	**Torque: lbf·ft (N·m)**
Spring Assembly U-Bolt High Nuts (Tighten in a diagonal pattern as shown in **Fig. 23**.)	5/8–18	Stage 1: Hand Tighten Stage 2: 60 (81) Stage 3: 200 (271) Stage 4: 180 to 230 (245 to 313)
	3/4–16	Stage 1: Hand Tighten Stage 2: 60 (81) Stage 3: 200 (271) Stage 4: 270 to 330 (367 to 449)
	7/8–14	Stage 1: Hand Tighten Stage 2: 60 (81) Stage 3: 200 (271) Stage 4: 420 to 500 (571 to 680)
	1–14	Stage 1: Hand tighten Stage 2: 60 (81) Stage 3: 200 (271) Stage 4: 520 to 600 (707 to 816)

Table 1, U-Bolt Torque Values

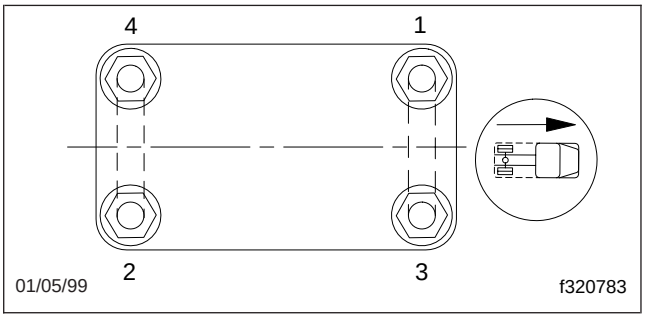


Fig. 23, Tightening Pattern for U-Bolt High Nuts

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
All-Axle Alignment Checking	33–03
Knuckle Pin Lubricating	33–01
Tie Rod Inspecting and Lubricating	33–02

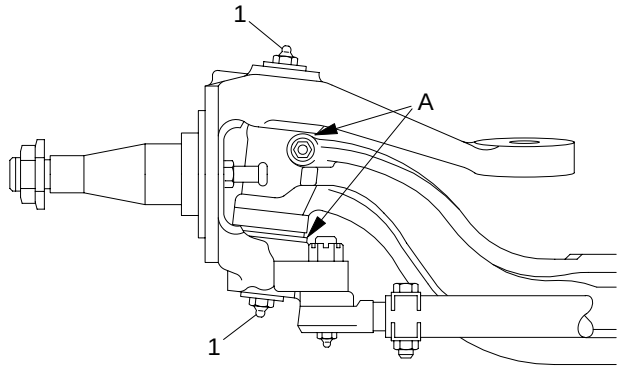
33–01 Knuckle Pin Lubricating

CAUTION

Use regulated pressure when lubricating the knuckle assemblies, otherwise damage could result to the knuckle caps.

Dana Spicer

Park the vehicle on a level surface, apply the parking brakes, and chock the tires. When lubricating upper and lower knuckle assemblies, do not raise the front axle. Wipe the fittings clean, then apply multipurpose chassis grease, NLGI grade 1 (6% 12-hydroxy lithium stearate grease) or NLGI grade 2 (8% 12-hydroxy lithium stearate grease), until new grease is seen at the junctions of the axle beam and knuckles. See **Fig. 1**. Knuckle pins without grease fittings are permanently lubricated.

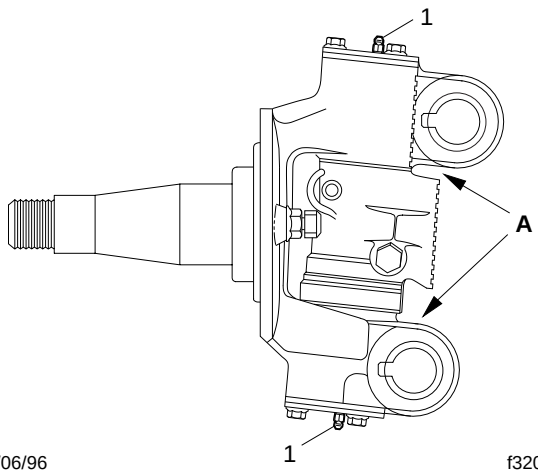


A. Grease Exit
1. Grease Fitting

Fig. 1, Dana Spicer Knuckle Pin Lubrication

Meritor

When lubricating knuckle pin bushings, do not raise the front axle. Wipe the lube fittings clean, and apply multipurpose chassis grease, NLGI grade 1 (6% 12-hydroxy lithium stearate grease) or NLGI grade 2 (8% 12-hydroxy lithium stearate grease) until new grease is seen at the bushing grease seal opposite the fittings. The grease seal will accept grease pressure without damage, and is designed to have grease pumped out through it during lubrication. Even if grease leaks out around the top, or bottom-plate gasket, continue pumping until new grease is seen at the bushing seal opposite the grease fitting. See **Fig. 2**.



A. Grease Exit
1. Grease Fitting

Fig. 2, Meritor Knuckle Pin Lubrication

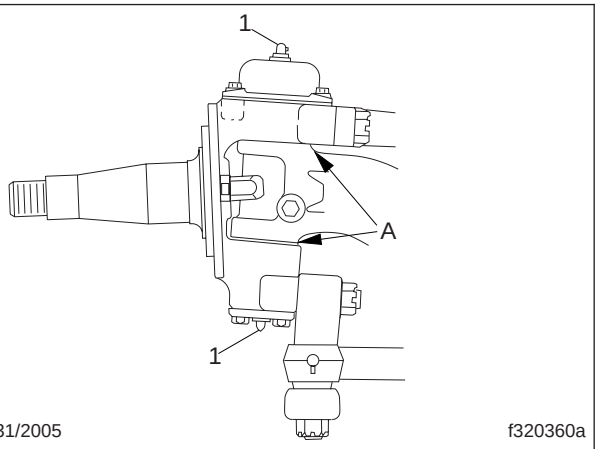
Freightliner

When lubricating upper and lower knuckle assemblies, do not raise the front axle. Wipe the lube fittings clean, and apply multipurpose chassis grease, NLGI grade 1 (6% 12-hydroxy lithium stearate grease) or NLGI grade 2 (8% 12-hydroxy lithium stearate grease) until new grease is seen at the junctions of the axle beam and knuckles. See **Fig. 3**.

33–02 Tie Rod Inspecting and Lubricating

Inspect the tie-rod ends as follows:

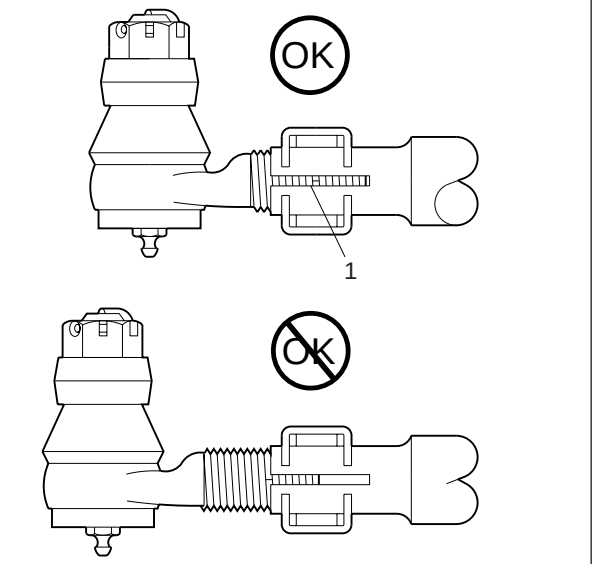
1. Shake the cross-tube. A loose fit, or movement between the tapered shaft of the ball and the cross-tube socket members indicates that the tie-rod end assembly must be replaced.
2. The threaded portion of the tie-rod end assembly must be inserted all the way into the cross-tube split for adequate clamping. See **Fig. 4**. Replace the components if this cannot be done. For instructions, see **Group 33** of the *Heavy-Duty Trucks Service Manual*.



Pump lubricant into each grease fitting until fresh grease come out at point *A*.

1. Grease Fitting

Fig. 3, Freightliner Knuckle Pin Lubrication



NOTE: Pinch bolt not shown to provide clarity.

1. Cross-Tube Split

Fig. 4, Tie-Rod End Adjustment

3. For any Dana Spicer, Meritor, or Freightliner axle that requires lubrication of the tie-rod ends, wipe the grease fittings clean, then pump multipurpose chassis grease, NLGI grade 1 (6% 12-hydroxy lithium stearate grease) or NLGI grade 2 (8% 12-hydroxy lithium stearate grease), into the tie-rod ends until all used grease is forced out and fresh grease is seen at the ball stud neck.

33–03 All-Axle Alignment Checking

Drive Axle Alignment Checking

Check the axle alignment, parallelism, and thrust angle measurements for the rear drive axles. Use the applicable procedure and specifications in **Group 35** of the *Heavy-Duty Trucks Service Manual*.

Toe-In Inspection

For vehicle alignment to be accurate, the shop floor must be level in every direction. The turn plates for the front wheels must rotate freely without friction, and the alignment equipment must be calibrated every three months by a qualified technician from the equipment manufacturer. Freightliner dealers must have proof of this calibration history.

1. Apply the parking brakes and chock the rear tires.
2. Raise the front of the vehicle until the tires clear the ground. Check that the safety stands will support the combined weight of the cab, axle, and frame. Place safety stands under the axle.
3. Using spray paint or a piece of chalk, mark the entire center rib of each front tire.
4. Place a scribe or pointed instrument against the marked center rib of each tire, and turn the tires. The scribe must be held firmly in place so that a single straight line is scribed all the way around each front tire.
5. Place a turn-plate or turntable under both front tires. Raise the front of the vehicle, remove the safety stands from under the axle, then lower the vehicle. Remove the lock-pins from the gauges; make sure the tires are exactly straight ahead.

NOTE: If turn-plates or turntables are not available, lower the vehicle. Remove the chocks from the rear tires and release the parking brakes. Move the vehicle backward and then forward about six feet (two meters).

6. Place a trammel bar at the rear of the front tires; locate the trammel pointers at spindle height, and adjust the pointers to line up with the scribe lines on the center ribs of the front tires. See **Fig. 5**. Lock in place. Check that the scale is set on zero.
7. Move the trammel bar to the front of the tires (see **Fig. 6**), and adjust the scale end so that the pointers line up with the scribe lines. See **Fig. 7**.
8. Read the toe-in from the scale, and compare it to the toe-in specification in **Group 33** of the *Heavy-Duty Trucks Service Manual*. If corrections are needed, see **Group 33** of the same manual for instructions on adjusting the toe-in.

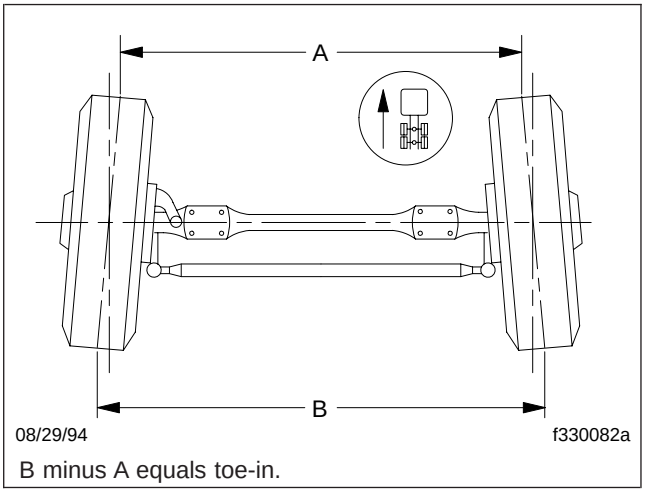


Fig. 5, Wheel Toe-In (Overhead View)

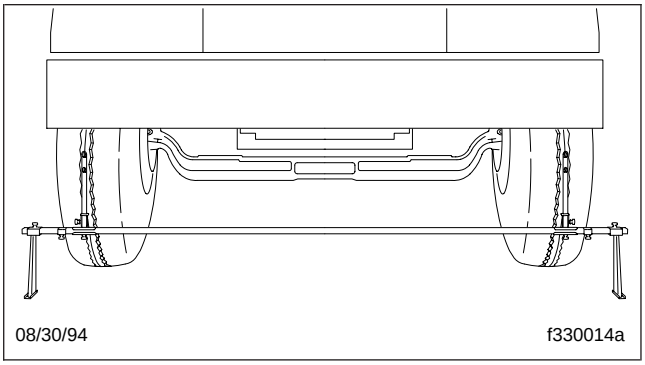


Fig. 6, Trammel Bar Positioning

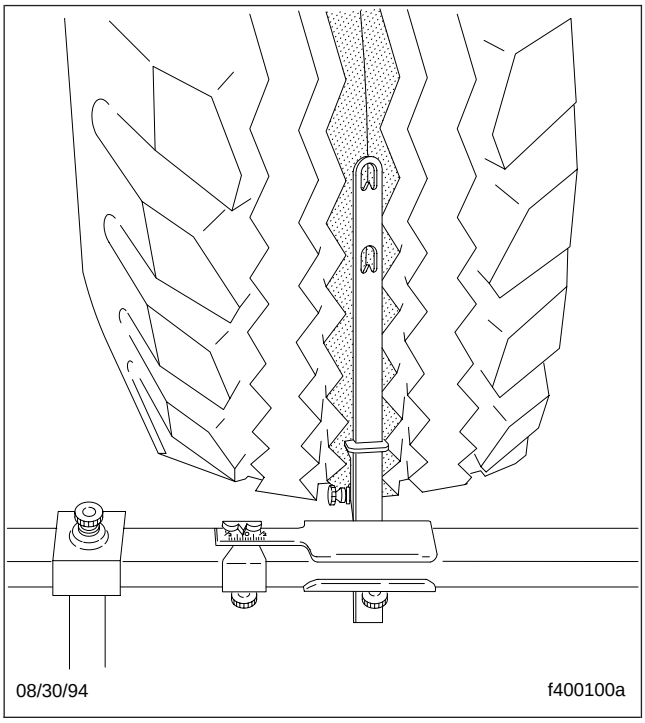


Fig. 7, Setting the Trammel Bar Pointers

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Axle Breather and Lubricant Level Checking	35–01
Axle Lubricant Changing, Oil Filter Replacing, and Magnetic Strainer Cleaning	35–02

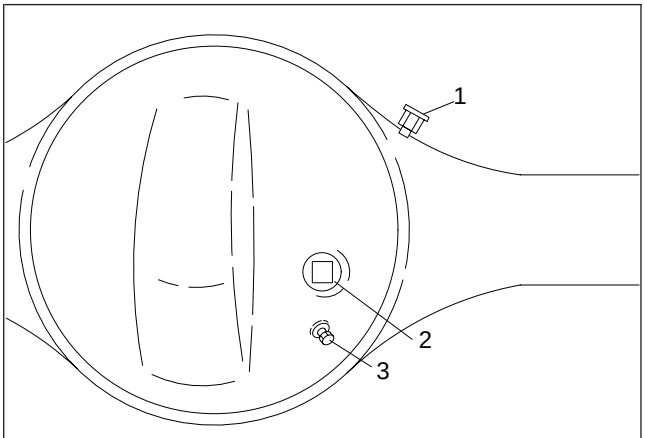
35–01 Axle Breather and Lubricant Level Checking

Eaton Axle Lubricant Level Checking

CAUTION

Failure to keep the rear axle filled to the proper level with the recommended lubricant can result in rear axle damage.

1. With the vehicle parked on level ground, apply the parking brakes, and chock the tires.
2. If the vehicle has just been driven, allow a few minutes for the lubricant to settle.
3. Clean the oil fill plug and area surrounding it, then remove the plug from the fill hole (**Fig. 1**) or from the standpipe (if so equipped) installed in the fill hole.



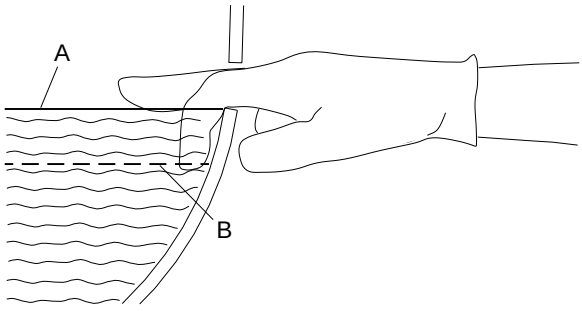
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1. Axle Housing Breather
2. Fill Plug
3. Temperature Indicator Plug

Fig. 1, Axle Housing

IMPORTANT: A lubricant level close enough to be seen or touched is not sufficient. It must be level with the bottom of the fill hole (**Fig. 2**) or top of the standpipe opening.

4. Lubricant should be level with the bottom of the fill hole (**Fig. 2**) or with the top of the standpipe opening. If low, check the axle for oil leaks, and correct as needed. Add lubricant as required. See **Table 1** for recommended drive axle lubricants.



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A. **Correct** (lube level at bottom of fill hole)
B. **Incorrect** (lube level below fill hole)

Fig. 2, Axle Lubricant Level Checking

Eaton Drive Axle Recommended Lubricant		
Lubricant Type	**Condition**	**Lubricant SAE Viscosity Grade**
Eaton® Roadranger® Synthetic Drive Axle Lubricants, or Equivalent with Military Specification MIL–L–2105D	Over-the-Road Service	75W–90
	Off-Highway Equipment, or Under Extra Heavy Loads	80W–140

Table 1, Eaton Drive Axle Recommended Lubricant

5. Install and tighten the fill plug 40 to 60 lbf·ft (54 to 81 N·m).
6. On non-drive axles equipped with oil-lubricated wheel bearings, check the lubricant level at the wheels. If low, add the same lubricant specified for the drive axle.

NOTE: When adding or checking lubricant of non-drive axles, clean the hub cap and plug before removing the plug. This minimizes the possibility of dirt entering the assembly

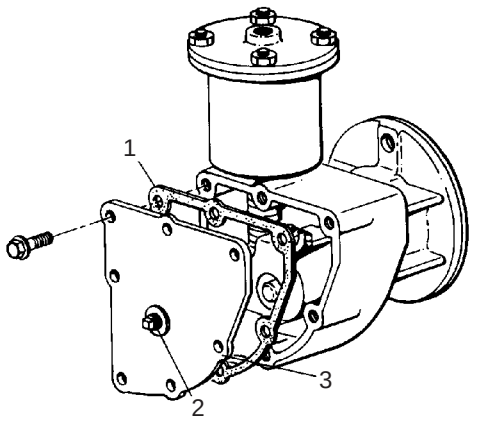
7. Remove the chocks from the tires.

Eaton Two-Speed-Axle Shift Unit Oil Level

CAUTION

Failure to keep lubricant at the specified level could cause damage to the axle shift unit.

1. Clean the shift unit oil fill plug, and area surrounding it. See **Fig. 3**. Remove the fill plug.



1. Housing Cover Gasket
2. Oil Fill Plug
3. Shift Unit Housing Cover

Fig. 3, Two-Speed-Axle Shift Unit

2. The lubricant level should be maintained at the bottom of the fill hole. If low, add specified lubricant.

CAUTION

Before adding additional lubricant, make sure of the type currently in the shift unit. To prevent component damage, do not mix engine oil with automatic transmission fluid.

IMPORTANT: When vehicle operating temperatures are above 0°F (–18°C), use SAE 10 heavy-duty engine oil, API service classification SD (sulfated ash content must not exceed 1.85%). When vehicle operating temperatures are below 0°F (–18°C), use one part kerosene to three parts SAE 10 heavy-duty engine oil, API service classification SD (sulfated ash content must not exceed 1.85%). This cold-weather mixture can be safely used up to 32°F (0°C).

Commercially available automatic transmission fluid may be used in place of SAE 10 engine oil. Automatic transmission fluid can be used for all temperatures; do not mix kerosene with it.

3. Apply a small amount of Loctite® 242, or equivalent sealant, to the threads of the fill plug. Install the fill plug finger-tight; then, using a wrench, tighten it 1-1/2 turns past finger-tight.

Eaton Axle Breather Checking

Axle housing breathers (**Fig. 1**) must remain unclogged. Whenever the axle lubricant level is checked, be sure the axle breather is open. Check more often under adverse operating conditions. If the breather is plugged or damaged, clean or replace it as needed.

Meritor Axle Lubricant Level Checking

CAUTION

Failure to keep the rear axle filled to the proper level with the recommended lubricant can result in rear axle damage.

1. With the vehicle parked on level ground, apply the parking brakes, and chock the tires.
2. Clean the fill plug in the side of the axle carrier, and the area surrounding it. See **Fig. 4**. Then remove the plug.

NOTE: Some Meritor axles have a small tapped and plugged hole near and below the housing oil fill hole. This smaller hole is for a lubricant temperature indicator only, and should not be used as a fill or level hole.

3. With the vehicle on level ground, lubricant should be level with the bottom of the fill hole. If low, check for oil leaks, correct as needed, then add specified lubricant. See **Table 2** for recommended drive axle lubricants.

Meritor Drive Axle Recommended Lubricant			
Recommended Lubricant Type	**Ambient Temperature**	**Lubricant SAE Viscosity Grade**	**Meritor Specification**
Hypoid Gear Oil API Service Classification GL–5	+10°F (–12.2°C) and up*	85W–140	0–76–A
	–15°F (–26.1°C) and up*	80W–140	0–76–B
	–15°F (–26.1°C) and up*	80W–90	0–76–D
	–40°F (–40°C) and up*	75W–90	0–76–E
	–40°F (–40°C) to +35°F (+2°C)	75W	0–76–J
	–40°F (–40°C) and up*	75W–140	0–76–L
Synthetic Gear Oil	–40°F (–40°C) and up*	75W–90	0–76–N
	–40°F (–40°C) and up*	75W–140	0–76–M

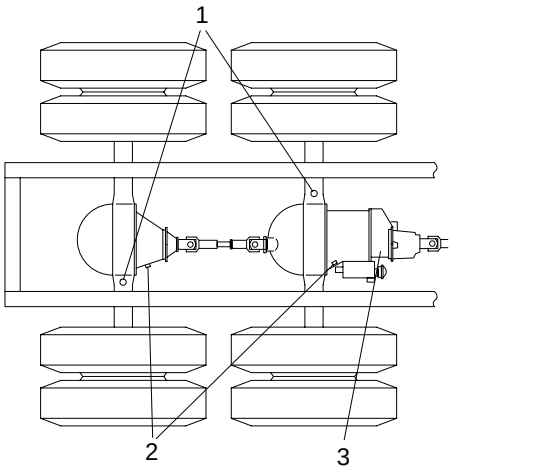
* There is no upper limit on these ambient temperatures, but axle sump temperature must never exceed 250°F (121°C).

Table 2, Meritor Drive Axle Recommended Lubricant

4. Install and tighten the fill plug 35 lbf·ft (47 N·m).

NOTE: When adding to or checking the oil level of non-drive axles, make certain the hub cap and plug are cleaned before removal of the plug; this will minimize the possibility of dirt and road grime entering the assembly.

5. On non-drive axles using oil-lubricated wheel bearings, check oil level at the wheels, and add oil if low. Use the same lubricant as specified for the drive axle.



1. Axle Housing Breathers
2. Carrier Oil Fill Plugs
3. Interaxle Differential

Fig. 4, Fill Plug and Axle Housing Breather Locations

Meritor Axle Breather Checking

Axle housing breathers (**Fig. 4**) must remain clean. Whenever the axle lubricant level is checked, check the axle breather to be sure it is open. Check more often under adverse operating conditions. If the breather is plugged, clean or replace it as needed.

35–02 Axle Lubricant Changing, Oil Filter Replacing, and Magnetic Strainer Cleaning

Eaton Axle Lubricant Changing and Magnetic Strainer Cleaner

⚠ CAUTION

Failure to change the axle lubricant at more frequent intervals, when adverse operating conditions require, could result in axle damage.

Draining is best accomplished immediately after the vehicle has completed a trip. The lubricant is warm then and will run freely, allowing full drainage in minimum time. This is especially desirable in cold weather.

1. With the vehicle parked on level ground, apply the parking brakes, and chock the tires.

2. Clean the fill plug and area surrounding it, then remove the plug from the oil fill hole (or standpipe if installed in the oil fill hole) located in the axle housing rear cover. See **Fig. 5**.
3. Remove the drain plug at the bottom of the axle housing (**Fig. 5**) and allow sufficient time for all old lubricant to run out.
4. On tandem drive axles, also remove the plug at the bottom of the power divider to drain oil from the power divider.

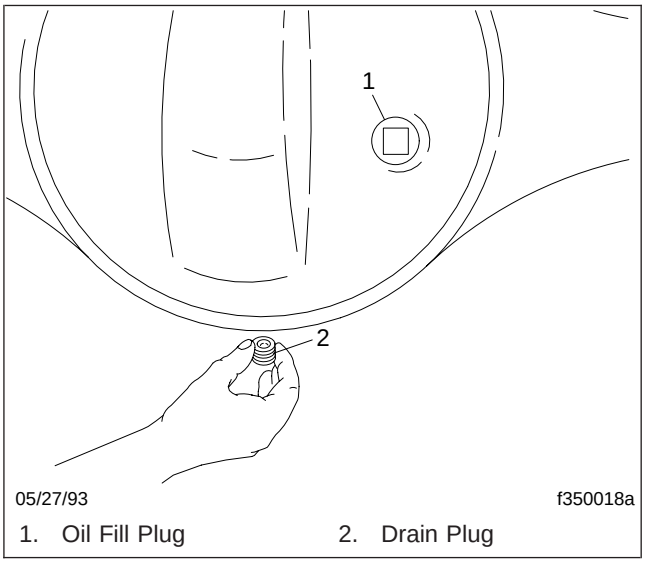


Fig. 5, Axle Housing Drain and Fill Plugs

NOTE: Some tandem drive axles are equipped with a cylindrical magnetic strainer, below the lube pump on the front of the power divider cover, that must be removed and cleaned at each axle oil change. See **Fig. 6**.

5. Remove and clean the magnetic strainer, if so equipped.
   - 5.1 Remove the magnetic strainer from the power divider cover.

⚠ WARNING

Always wear eye protection when using compressed air to clean parts, as flying debris could cause permanent damage to unprotected eyes. Do not point the air stream in the direction of other persons.

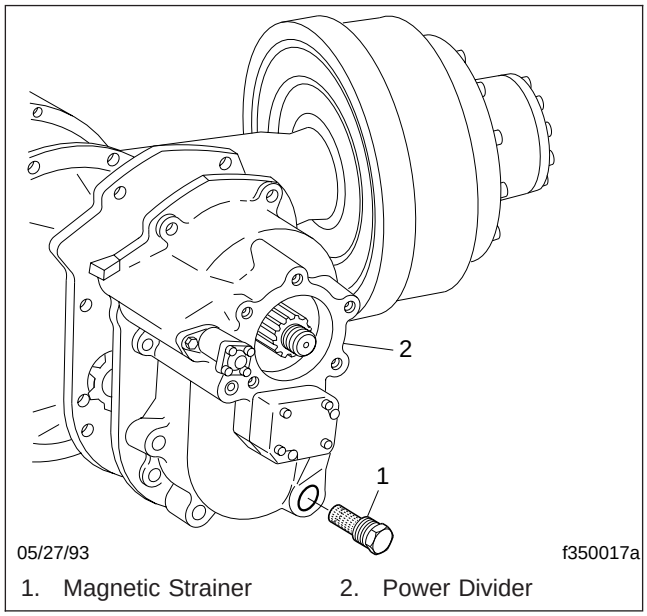


Fig. 6, Eaton Tandem-Drive-Axle Magnetic Strainer

   - 5.2 Wash the strainer in solvent, and blow it dry with compressed air to remove oil and metal particles.
   - 5.3 Install and tighten the magnetic strainer 40 to 60 lbf·ft (54 to 81 N·m).
6. Clean the fill and drain plugs. To facilitate cleaning of magnetic plugs, a piece of key stock or any other convenient steel slug may be used to short the two magnetic poles and divert the magnetic field.

IMPORTANT: Magnets will rapidly lose effectiveness as collected material bridges the gap between the two poles. Clean or change the plugs before this occurs. It may be necessary to clean or change the plugs one or more times between lubrication change intervals.

7. After cleaning, install and tighten the drain plug(s) 40 to 60 lbf·ft (54 to 81 N·m).
8. Fill the axle with the recommended lubricant. See **Table 1** for recommended drive axle lubricants, and **Table 3** or **Table 4** for drive axle lubricant capacities.

Eaton Single Drive Axle Lubricant Capacities		
Axle Type	**Axle Model**	**Capacity*: pints (liters)**
Single Reduction	23085S, 23085D	40 (18.9)
	23105S, 23105D	48 (22.7)
	23121	41 (19.4)
	30105S	46 (21.8)
Double Reduction	35055P	36 (17.0)

* Quantities listed are approximate. Fill axle until lubricant is level with bottom of fill hole with vehicle on level ground.

Table 3, Eaton Single Drive Axle Lubricant Capacities

NOTE: Some Eaton axles have a small tapped and plugged hole near and below the housing oil fill hole. See **Fig. 1**. This smaller hole is for a lubricant temperature indicator only, and should not be used as a fill or level hole.

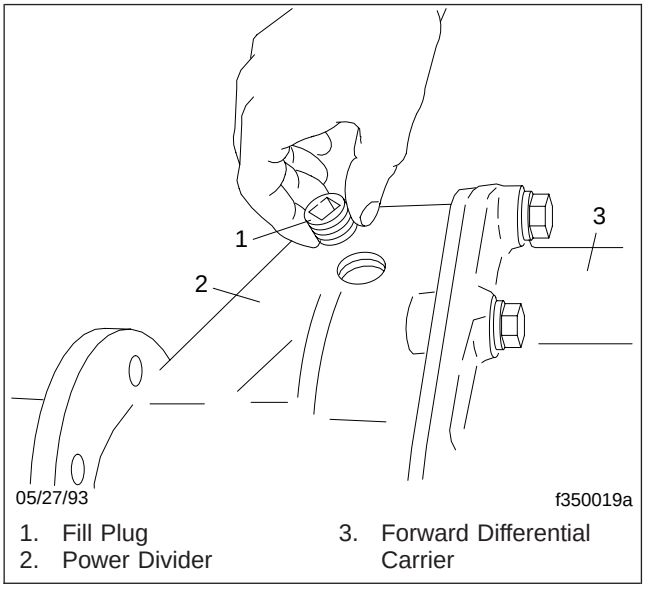
8.1 Using recommended lubricant, fill the axle through the oil fill hole or standpipe opening. Lubricant should be level with the bottom of the oil fill hole (**Fig. 2**) or top of the standpipe opening.

8.2 Install and tighten the fill plug 40 to 60 lbf·ft (54 to 81 N·m).

8.3 For forward drive axles, remove the power divider fill plug, located slightly offset to the right in the top portion of the forward differential carrier. See **Fig. 7**. Add two pints (1 L) of lubricant through this fill hole. Do not use the hole at the *top* of the differential carrier as a fill hole. Install and tighten the fill plug 40 to 60 lbf·ft (54 to 81 N·m).

Eaton Two-Speed Axle Shift Unit Oil Changing

1. Remove the shift unit housing cover (**Fig. 3**). Drain and discard the old lubricant. Discard the housing cover gasket.
2. Thoroughly wash the axle shift parts and housing cover, and allow them to air dry.
3. Install the housing cover and a new cover gasket. Tighten the housing cover capscrews 90 to 110 lbf·in (1020 to 1240 N·cm), then remove the oil fill plug from the cover.



1. Fill Plug
2. Power Divider
3. Forward Differential Carrier

Fig. 7, Power Divider Fill Plug

IMPORTANT: When vehicle operating temperatures are above 0°F (–18°C), use SAE 10 heavy-duty engine oil, API service classification SD (sulfated ash content must not exceed 1.85%). When vehicle operating temperatures are below 0°F (–18°C), use one part kerosene to three parts SAE 10 heavy-duty engine oil, API service classification SD (sulfated ash content must not exceed 1.85%). This cold-weather mixture can be safely used up to 32°F (0°C).

Commercially available automatic transmission fluid may be used in place of SAE 10 engine oil. Automatic transmission fluid can be used for all temperatures; do not mix kerosene with it. To prevent component damage, do not mix engine oil and automatic transmission fluid.

4. Fill the shift unit housing through the oil fill hole until specified lubricant is level with the bottom of the opening.
5. Apply a small amount of Loctite® 242, or equivalent sealant, to the threads of the fill plug. Install the plug finger-tight; then, using a wrench, tighten it 1-1/2 turns past finger-tight.

Eaton Tandem Drive Axle Lubricant Capacities					
Axle Type	**Axle Model**	**Capacity*: pints (liters)**	**Axle Type**	**Axle Model**	**Capacity*: pints (liters)**
Single Reduction	DS341	39 (18.5)†	Dual Range (2-Speed)	DT401, 401–P	39 (18.5)†
	RS341	36 (17)		RT401	36 (17)
	DS381, 381–P	39 (18.5)†		DT402, 402–P	34 (16.1)†
	RS381	36 (17)		RT–402	34 (16.1)
	DS401, 401–P	39 (18.5)†		DT451, DT451–P	39 (18.5)†
	RS401	36 (17)		RT451	34 (16.1)
	DS402, 402–P	39 (18.5)†		DT461–P	43 (20.3)†
	RS402	36 (17)		RT461	40 (18.9)
	DS404	39 (18.5)†	Double Reduction	DP451–P	34 (16.1)†
	RS404	36 (17)		RP451	34 (16.1)
	DS451, 451–P	39 (18.5)†		DP461–P	43 (20.3)†
	RS451	36 (17)		RP461	40 (18.9)
	DS460–P	44 (20.8)†		DP521–P	42 (19.9)†
	RS460	40 (18.9)		RP521	39 (18.5)
	DS461–P	43 (20.3)†		DP601–P	42 (19.9)†
	RS461	40 (18.9)		RP601	39 (18.5)
	DS581–P	42 (19.9)†		DP651–P	41 (19.4)†
	RS581	39 (18.5)		RP651	37 (17.5)

* Quantities listed are approximate. Fill axle until lubricant is level with bottom of fill hole with vehicle on level ground.

† Add 2 pints (1 L) of additional lubricant to the power divider.

Table 4, Eaton Tandem Drive Axle Lubricant Capacities

Meritor Axle Lubricant Changing and Oil Filter Replacing

Axle Lubricant Change-Interval Information

A regular schedule for changing axle lubricant in a particular vehicle and operation can be accurately determined by analysis of oil samples taken from the assembly at specific intervals or mileages. The final schedule recommended may, for economic reasons, be correlated with lubricant changes governed by climatic conditions and magnetic plug maintenance. Lubricant changes should be made as climatic temperatures demand, regardless of vehicle mileage or established change schedule.

Normal operating temperature of compounded lubricants during the summer season is approximately 160 to 220°F (71 to 104°C). Chemicals and additives that give these lubricants increased load-carrying capacity, oxidize faster at temperatures above 220°F (104°C), contributing to more rapid lubricant deterioration. For this reason, lubricants of this type, that operate continuously at high temperatures, must be changed more frequently to realize the inherent advantages they offer.

⚠ CAUTION

Failure to change the axle lubricant at more frequent intervals, when adverse operating conditions require, could result in axle damage.

Traction Equalizer Additives

Single drive axles equipped with traction equalizers may require a "limited-slip friction modifier" to correct a slip-stick condition, as described in the vehicle driv-

er's manual. Meritor's experience shows that the following additives (friction modifiers) perform adequately:

A. For all GL–5 gear oils (mineral oil or synthetic) other than Mobil, add any of the following (1.6 ounces [35 mL] of additive for each pint [0.5 L] of lube capacity):
   - Elco No. 2 Friction Modifier (Elco Corporation).
   - Lubrizol No. 6178 (Lubrizol Corporation).
   - Hi–Tec E–336 (Edwin Cooper, Inc.).
   - Equa–Torque No. 2411 (Sta–Lube Corporation).
   - Equa–Torque No. 2414 (Sta–Lube Corporation).

B. For Mobilube HD (mineral oil) and Mobilube SHC (synthetic) use Mobil No. 204 (Mobil Oil Corporation). Add 1.1 ounces [23 mL] of additive for each pint [0.5 L] of lube capacity.

IMPORTANT: These friction modifiers generally deteriorate faster than conventional extreme-pressure additives, so the lubricant change schedule must be shortened when using these additives. The traction equalizer additive (and recommended drive axle lubricant) must be changed at the Maintenance 2 (M2) interval, instead of the Maintenance 3 (M3) interval recommended in the Maintenance Operation Chart for axles that require only those lubricants recommended in **Table 2**.

Axle Lubricant and Oil Filter Replacement Procedure

1. With the vehicle parked on level ground, apply the parking brakes, and chock the tires.
2. Remove the axle carrier fill plug (**Fig. 4**), then remove the drain plug at the bottom of the housing and completely drain the lubricant while the unit is warm. Allow sufficient time for all old lubricant to drain. On tandem drive axles, it is also necessary to remove the plug at the bottom of the interaxle differential housing to drain the lubricant.
3. If so equipped, replace the axle oil filter.

IMPORTANT: When the drive unit is equipped with an oil filter, the filter should be replaced every time the oil is changed.

3.1 To remove the filter from the helical gear cover, remove only the two relief valve cover stud nuts and washers, then lift off the filter cover. Do not remove the capscrews. See **Fig. 8**.

3.2 Remove the oil filter, using a suitable filter strap wrench. See **Fig. 9**. Discard the filter.

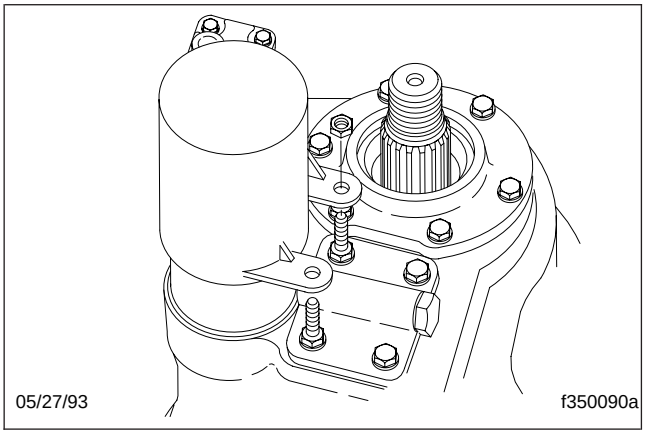


Fig. 8, Axle Oil Filter Cover Removal and Installation

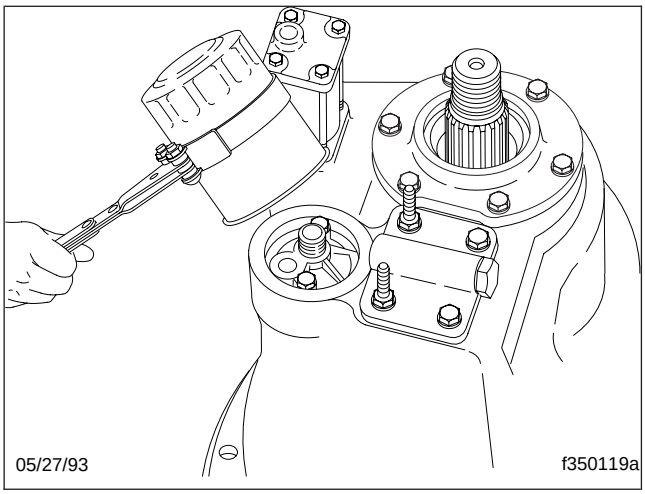


Fig. 9, Axle Oil Filter Removal

NOTE: There may be about one pint (0.5 L) of lubricant remaining in the filter. Be careful not to spill it when removing the filter.

3.3 Remove the capscrews, washers, and oil filter adapter from the gear cover; then inspect the threads of the filter mounting tube and adapter casting. See **Fig. 10**. If the threads are stripped or the casting is cracked, replace the damaged component.

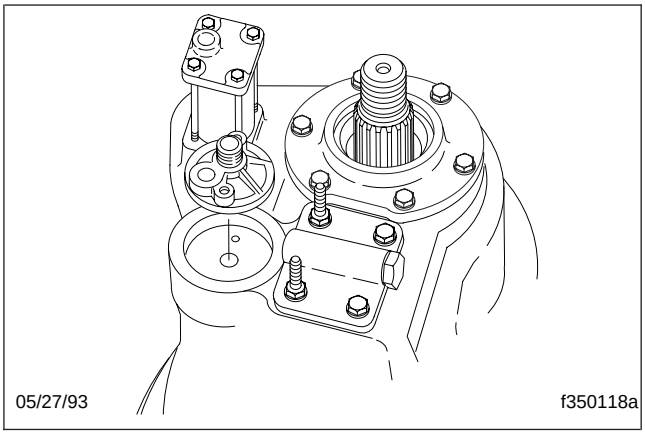


Fig. 10, Axle Oil Filter Adapter Removal and Installation

3.4 Place the oil filter adapter in its bore. Install the washers and capscrews, then tighten the capscrews 20 to 30 lbf·ft (27 to 41 N·m).

3.5 Using the specified drive axle lubricant, coat the face of the gasket on a new oil filter. Install the filter over the adapter, tighten the filter one full turn after the gasket contacts the base; do not overtighten the filter.

3.6 Assemble the filter cover over the filter and shouldered studs, and secure it with two nuts and washers. Tighten the nuts 10 to 15 lbf·ft (14 to 20 N·m).

4. For a new or reconditioned axle, flush the axle with clean flushing oil, then drain it thoroughly. It is necessary to flush the axle the first time (only) that the axle lubricant is changed.

IMPORTANT: Axles should not be flushed with any solvent, such as kerosene.

5. Clean the fill and drain plugs. For magnetic plugs, a piece of key stock or any other convenient steel slug may be used to short the two magnetic poles and divert the magnetic field.

NOTE: Meritor recommends plugs with elements having a minimum pickup capacity of 1-1/2 pounds (0.7 kg) of low-carbon steel, in plate or bar form. Magnets will rapidly lose effectiveness as collected material bridges the gap between the two poles. Clean or change the plugs before this occurs. It may be necessary to clean or change the plugs one or more times between lubrication change intervals.

6. After cleaning the drain plug(s), install and tighten it 35 lbf·ft (47 N·m).

7. With the vehicle on a level surface, fill the axle housings to the bottom of the fill hole, using specified lubricant. See **Table 2** for recommended axle lubricants, and **Table 5** or **Table 6** for drive axle lubricant capacities.

NOTE: Some Meritor axles have a small tapped and plugged hole near and below the housing lubricant fill hole. This smaller hole is for a lubricant temperature indicator only, and should not be used as a fill or level hole.

8. Install and tighten the fill plug 35 lbf·ft (47 N·m).

9. Whenever the interaxle differential housing has been drained, add an additional 2 pints (1 L) of specified lubricant directly into the interaxle differential housing.

10. Remove the chocks, then drive the vehicle, unloaded, for 1 or 2 miles (2 or 3 km) at speeds not to exceed 25 mph (40 km/h), to thoroughly circulate lubricant throughout the carrier and housing assemblies.

Meritor Single Drive Axle Lubricant Capacities

Axle Type	Axle Model	Capacity*: pints (liters)
Single Reduction	RS–23–160	39.5 (18.7)
	RS–23–161	37.2 (17.6)
	RS–23–180	47.3 (22.4)
	RS–26–180	46.6 (22.0)
	RS–30–180	46.6 (22.0)

Meritor Single Drive Axle Lubricant Capacities		
Axle Type	**Axle Model**	**Capacity*: pints (liters)**
Double Reduction	RS–26–380	58.2 (27.5)
	RS–30–380	46.6 (22.0)
	RS–38–380	58.2 (27.5)

* Quantities listed are approximate. Fill axle until lubricant is level with bottom of fill hole with vehicle on level ground.

Table 5, Meritor Single Drive Axle Lubricant Capacities

Meritor Tandem Drive Axle Lubricant Capacities					
Axle Type	**Axle Model**	**Capacity*: pints (liters)**	**Axle Type**	**Axle Model**	**Capacity*: pints (liters)**
Single Reduction	Q–100	Forward 40.0 (18.9) Rear 37.0 (17.5)	Single Reduction	SQ–100P	Forward 42.0 (19.9) Rear 37.0 (17.5)
	RT–40–140	Forward 30.2 (14.3) Rear 22.8 (10.8)		SQR–100	Forward 36.0 (17.0) Rear 33.0 (15.6)
	RT–40–145 and –145P	Forward 30.2 (14.3) Rear 25.8 (12.2)		SQR–100P	Forward 38.0 (18.0) Rear 33.0 (15.6)
	RT–44–145 and –145P	Forward 29.3 (13.9) Rear 25.1 (11.9)		SR–170	Forward 55.0 (26.0) Rear 43.0 (23.3)
	RT–46–160 and –160P	Forward 39.1 (18.5) Rear 34.4 (16.3)		SSHD	Forward 34.0 (16.0) Rear 28.0 (13.0)
	RT–48–180	Forward 61.1 (28.9) Rear 38.8 (17.4)	Double Reduction	RT–48–380	Forward 61.1 (28.9) Rear 63.6 (30.1)
	RT–52–160 and –160P	Forward 44.1 (20.9) Rear 41.2 (19.5)		RT–52–380	Forward 56.1 (26.5) Rear 58.2 (27.5)
	RT–52–180	Forward 56.1 (26.5) Rear 41.2 (19.5)		RT–58–380	Forward 56.1 (26.5) Rear 58.2 (27.5)
	RT–58–180	Forward 56.1 (26.5) Rear 36.1 (17.1)		RT–70–380	Forward 54.4 (25.7) Rear 53.1 (25.1)
	SQ–100A	Forward 40.0 (18.9) Rear 37.0 (17.5)			

* Quantities listed are approximate. Fill axle until lubricant is level with bottom of fill hole with vehicle on level ground.

Table 6, Meritor Tandem Drive Axle Lubricant Capacities

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Wheel Nut and Rim Nut Checking	40–01

40–01 Wheel Nut and Rim Nut Checking

IMPORTANT: In addition to the maintenance interval in the general information section, check the wheel (or rim) nut torque the first 50 to 100 miles (80 to 160 km) of operation after a wheel has been removed and installed.

See **Table 1** for wheel nut torque specifications, and see **Fig. 1** for the wheel nut tightening sequence.

⚠ CAUTION

Insufficient wheel nut (rim nut) torque can cause wheel shimmy, resulting in wheel damage, stud breakage, and extreme tire tread wear. Excessive wheel nut torque can break studs, damage threads, and crack discs in the stud hole area. Use the recommended torque values, and follow the sequence shown in Fig. 1.

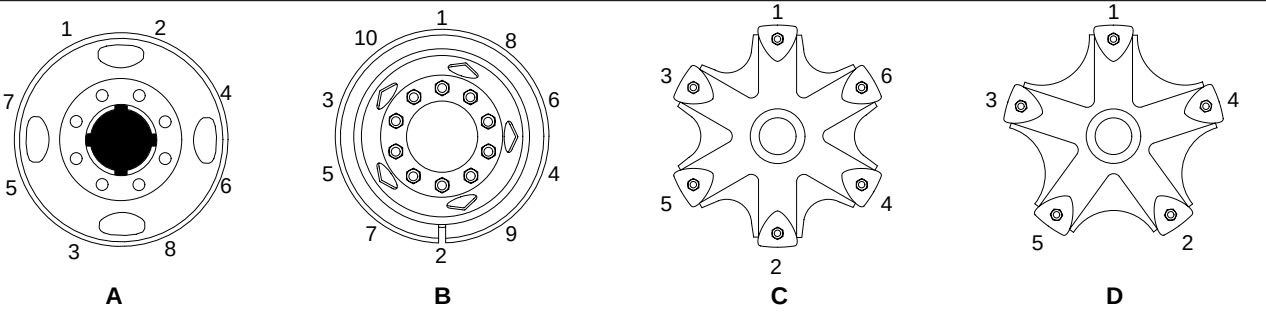
When checking wheel nuts on a dual disc assembly, remove one outer nut at a time, tighten the inner nut, then reinstall the outer nut. Repeat this procedure for all wheel nuts, using the sequence shown in **Fig. 1**.

Wheel Fastener Torque			
Description	**Nut Size**	**Wheel Manufacturer**	**Torque (dry threads): lbf·ft (N·m)**
8-Stud Disc Wheel With Two-Piece Flanged Locknuts			
Front and Rear Wheel Nut	—	All	450–500 (610–680)*
10-Stud Disc Wheel With Two-Piece Flanged Nuts			
Front and Rear Wheel Nut	M22 x 1.5	Budd (Uni–Mount 10)	390–440 (530–600)*
10-Stud Disc Wheel With Inner and Outer Locknuts			
Front Wheel Nut	1-1/8–16	Alcoa	400–500 (540–680)
		All Others	450–500 (610–680)
Rear Wheel Inner Nut	3/4–16	Alcoa	400–500 (540–680)
		All Others	450–500 (610–680)
Rear Wheel Outer Nut	1-1/8–16	Alcoa	400–500 (540–680)
		All Others	450–500 (610–680)
Wheel Stud Retainer Nut	3/4–16	All	175–200 (235–270)
Spoke Wheel Rim Nuts			
Front Wheel Nut, 5- and 6-Spoke	3/4–10	Gunite and Dayton	200–225 (271–305)†
Rear Wheel Nut, 5- and 6-Spoke With Non-Corrugated Channel Spacer **(Fig. 2)**	3/4–10	Gunite and Dayton	200–225 (271–305)
Rear Wheel Nut, 5- and 6-Spoke With Corrugated Channel Spacer **(Fig. 3)**	3/4–10	Gunite and Dayton	240–260 (325–350)

* Torque values given are for lubricated threads.

† On front axles with over 12,000 lbs (5448 kg) capacity, tighten the wheel nuts 240 to 265 lbf·ft (325 to 359 N·m). Gunite part number W–854 nut with a phosphate-and-oil coating must be used.

Table 1, Wheel Fastener Torque



A. 8-Stud Disc Wheel
B. 10-Stud Disc Wheel
C. 6-Spoke Wheel
D. 5-Spoke Wheel

Fig. 1, Wheel Nut and Rim Nut Tightening Sequence

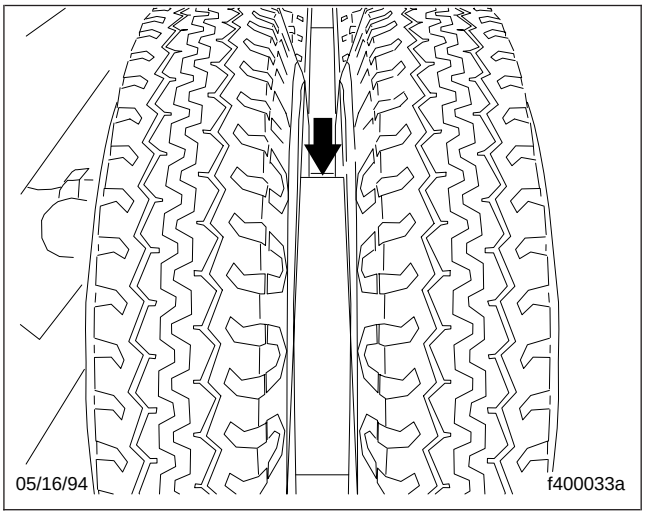
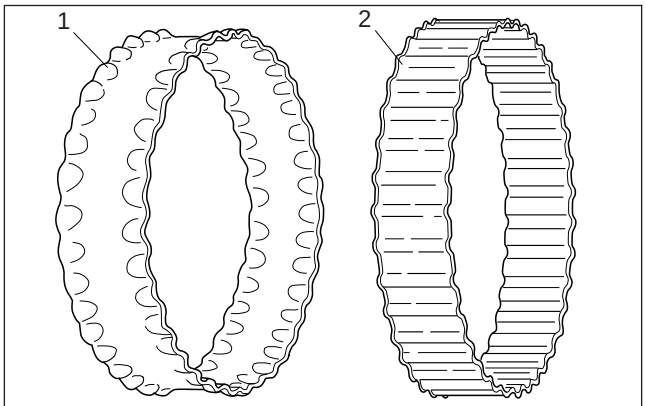


Fig. 2, Non-Corrugated Channel Spacer



1. Corrugated Spacer
2. Corrugated-Channel Spacer

Fig. 3, Corrugated Spacers

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Driveline Inspecting	41–01
Driveline Lubricating	41–02

41–01 Driveline Inspecting

Before lubricating driveline U-joints and slip joints, proceed as follows:

⚠ CAUTION

Do not over-tighten bearing-cap capscrews or yoke-strap capscrews. Due to the extreme load occurring at high-speed rotation, a loose or broken capscrew at any point in the driveline will weaken the driveline connection, which could eventually result in serious vehicle damage.

1. For each full-round driveline yoke with lockstraps (see **Fig. 1**, Ref. A) check to be sure the lockstraps are locked. The locking tab must be firmly locked against a flat side of the capscrew head. If not locked, tighten the bearing-cap capscrew, then bend a tab of the lockstrap upwards until it is firm against a flat side of the capscrew head.

   For each full-round driveline yoke with thread-locking capscrews, tighten the bearing-cap capscrews. See **Fig. 1**, Ref. B.

   For each half-round driveline yoke, tighten the yoke-strap capscrews. See **Fig. 2**, Ref. 6.

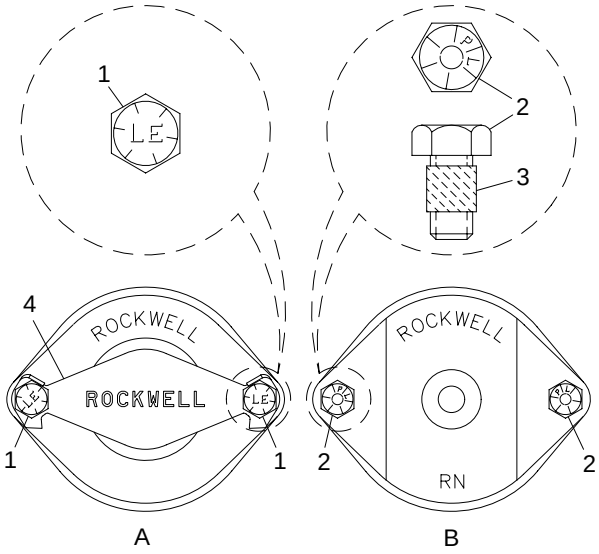
   Tighten all U-joint bearing cap fasteners to the torque values given in **Table 1**.

Fastener Torque Values		
Description	**Size**	**Torque: lbf·ft (N·m)**
Yoke-Strap Capscrew	1/2–20	130 (176)
Bearing-Cap Capscrew	5/16–24	24 (33)
	3/8–24	37 (50)
	7/16–20	60 (81)

Table 1, Fastener Torque Values

2. Check each input and output end yoke (see **Fig. 2**) for cracks and looseness. Replace cracked yokes.

   If any end yoke can be moved in or out on its shaft, or can be rocked on its shaft, disconnect the driveshaft and U-joint from the end yoke, then check the drive component's shaft seal for leakage or other visible damage that may have been caused by the loose yoke. Replace the seal if needed, then tighten the end yoke nut.



A. U-Joint With a Lockplate (for a vehicle built before April 1, 1994).
B. U-Joint With Self-Locking Capscrews (for a vehicle built from April 1, 1994).
1. Capscrew (not self-locking)
2. Self-Locking Capscrew
3. Adhesive Band
4. Lockplate

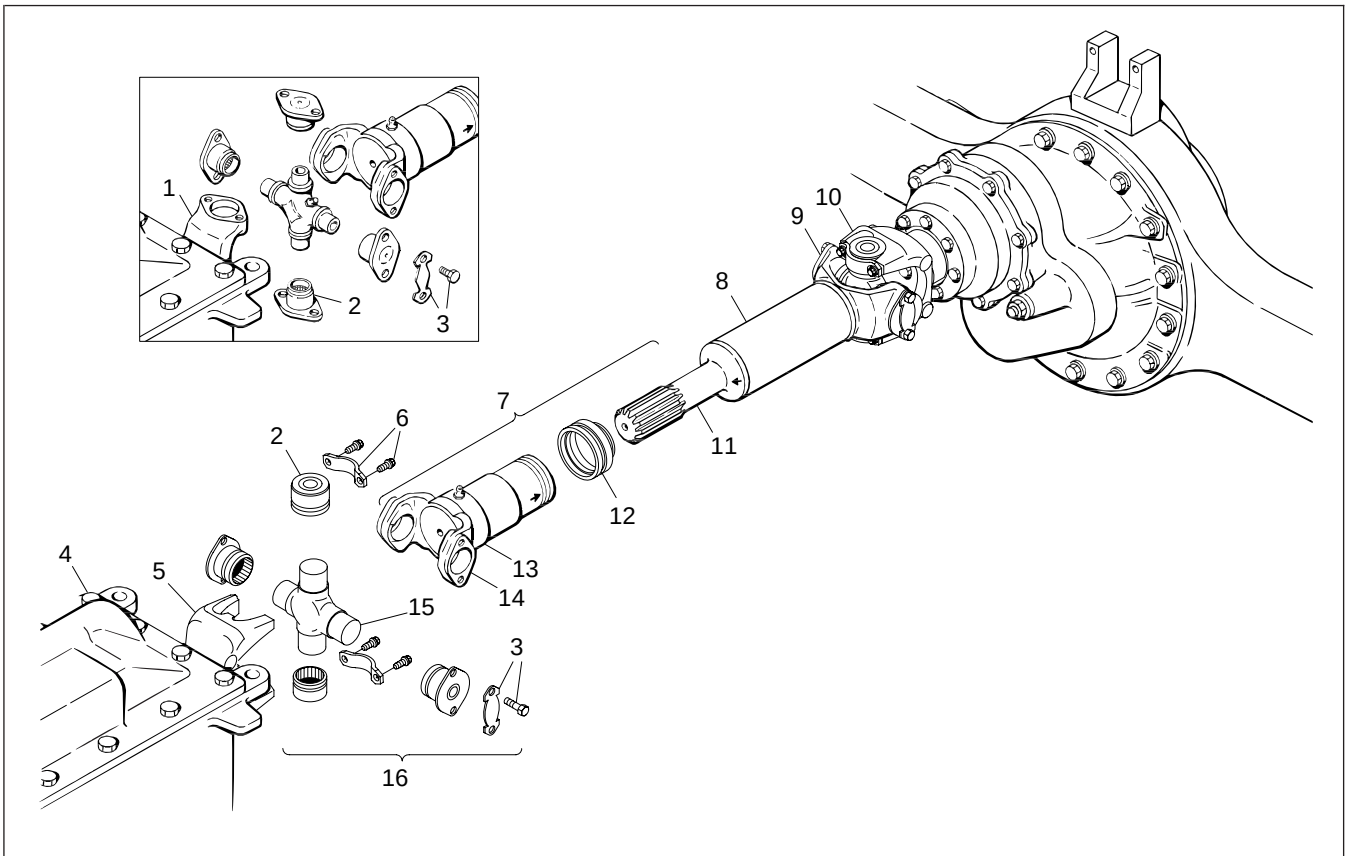
Fig. 1, Bearing Cap Capscrews

   For torque values, see **Group 41** of the *Heavy-Duty Trucks Service Manual*. If the end yoke is still loose after tightening the yoke nut, replace the yoke and yoke nut.

   Replace the prevailing torque locknut (end yoke nut) if it was removed for end yoke replacement, seal replacement, or any other reason.

3. Check U-joint assemblies for wear by attempting to move the driveshaft up and down, and from side to side. If movement of the U-joint cross in the bearings can be felt or seen, replace the complete U-joint.

4. Check the midship bearing and mounting for looseness and deterioration by attempting to move the driveshaft up and down, and from side to side. If the bearing is loose on its shaft, or rattles, replace it. If the bearing mount is loose on the frame, tighten the mounting bolt nuts to the applicable torque value in the torque tables in the general information section. Replace the



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NOTE: Not all fasteners are shown.

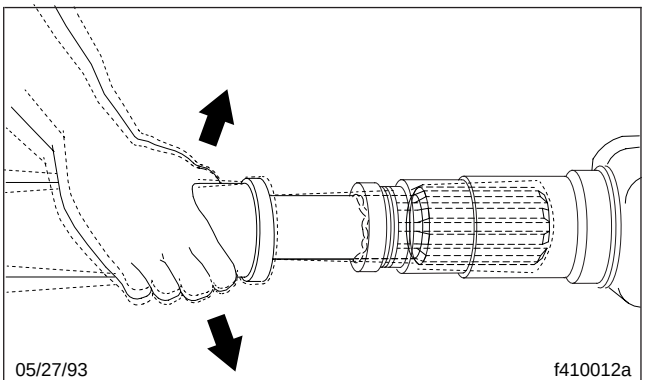
1. Full-Round End Yoke
2. Bearing Cap
3. Lockplate and Capscrew
4. Main Transmission
5. Half-Round End Yoke
6. Yoke Strap and Capscrew
7. Slip Joint Assembly
8. Driveshaft Tube
9. Driveshaft Yoke (Full-Round)
10. Input Shaft End Yoke (Half-Round)
11. Splined Shaft
12. Slip Joint Seal Assembly
13. Sleeve Yoke (Full-Round)
14. Yoke Lug
15. U-Joint Cross
16. U-Joint Assembly

Fig. 2, Driveline Assembly

midship bearing assembly if the rubber cushion is deteriorated or oil-soaked.

5. Check slip joints for spline wear by attempting to bend the sleeve yoke and splined shaft back and forth. See **Fig. 3**. If radial looseness is greater than 0.007 inch (0.18 mm), replace both the sleeve yoke and the splined shaft.
6. Visually examine the driveshaft tubes for dents, bends, twists, or other damage. If any tube appears to be damaged, remove the driveshaft and check the run-out on the tube. If the tube is not straight (and cannot be straightened) within 0.005 inch (0.127 mm) on the slip-joint-seal surface of the splined shaft, 0.010 inch (0.254 mm) on the tube 3 inches (76 mm) from the front and rear welds, and 0.015 inch (0.381 mm) at the center of the tube, replace the tube. See **Fig. 4**.

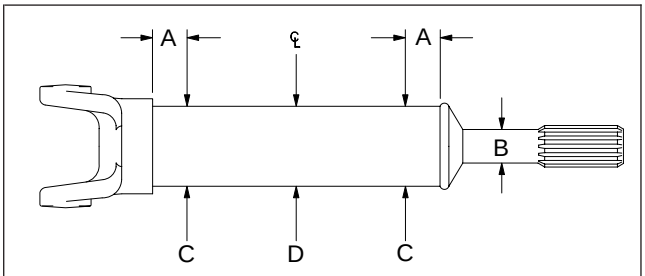
   If the driveshaft tube requires straightening or replacement, balance the repaired driveshaft before installing it.
7. Examine the driveshaft for evidence of missing balance weights, and for build-up of foreign material. Remove any foreign material. If there is



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Attempt to bend the sleeve yoke and splined shaft back and forth.

Fig. 3, Slip Joint Spline Wear Checking



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A. Measurement: 3" (76 mm)
B. Measurement: 0.005" (0.127 mm)
C. Measurement: 0.010" (0.254 mm)
D. Measurement: 0.015" (0.381 mm)

Fig. 4, Driveshaft Runout Specifications

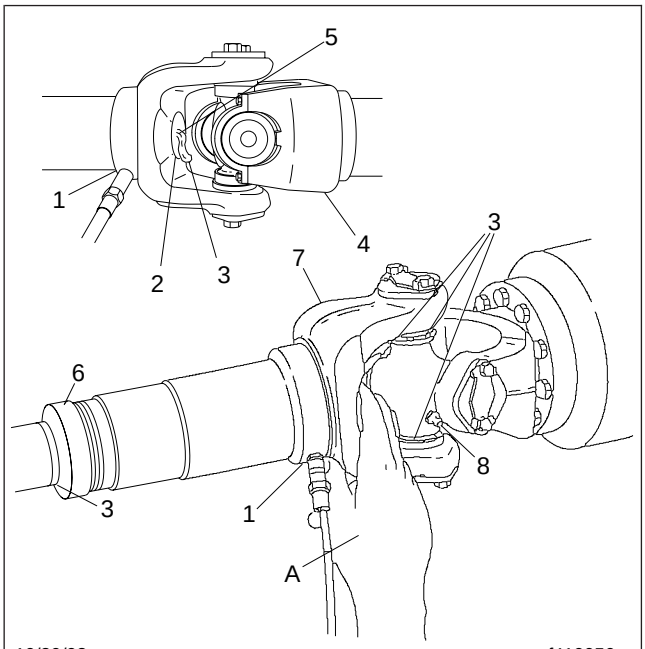
any evidence that balance weights are missing, remove the driveshaft and have it balanced.

8. For driveshafts with slip joints, check to be sure the yoke plug is not loose or missing. See **Fig. 5**, Ref. 2. Repair or replace the yoke plug as needed. If the yoke plug is missing, the splined shaft may be hitting the plug and knocking it out; contact your Regional Service Office for assistance in determining the correct driveshaft length.

41–02 Driveline Lubricating

U-joint Lubricating

1. Wipe all old grease and dirt from each U-joint grease fitting. See **Fig. 5**, Ref. 8.



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A. After grease appears, cover the pressure-relief hole while continuing to lubricate.

1. Slip Joint Grease Fitting (with grease gun attached)
2. Yoke Plug
3. Grease
4. Half-Round Yoke
5. Yoke Plug Pressure-Relief Hole
6. Slip Joint Seal
7. Full-Round Yoke
8. U-Joint Grease Fitting

Fig. 5, Slip Joint and U-Joint Lubricating

2. Use a hand-type grease gun, or a high-pressure gun with a low-pressure adapter, to lubricate U-joints. If a low-pressure adapter is not used with the high-pressure gun, the U-joints may not receive enough grease.

   Using lithium 12-Hydroxy stearate grease (NLGI grade 1 or grade 2, with EP additives), lubricate until *new* grease can be seen at *all four* U-joint seals.

IMPORTANT: Fresh grease must be seen escaping from *all four* bearing-cap seals of each U-joint. On full-round yokes, if most of the grease being added to a U-joint can be seen escaping from just one of the U-joint seals, bend the tabs of the lockstrap (if equipped) away from the heads of the bearing-cap capscrews, then check the torque on the capscrews at that seal. Tighten the bearing-cap capscrews

to the torque values given in **Table 1**. If equipped, bend the lockstrap tabs up, against a flat side of each capscrew head. If the capscrews were already tight, or all of the U-joint seals still do not purge, remove the bearing cap at that seal, and examine the seal for damage. If the seal is damaged, replace the complete U-joint.

If grease does not appear at one seal, use a screwdriver to pry the U-joint trunnion away from the non-purging seal, or tap the driveshaft or yoke with a plastic or rawhide mallet on the side opposite the dry seal, while continuing to lubricate. If grease still does not appear, bend the tabs of the lockstrap away from the heads of the bearing-cap capscrews, then loosen the capscrews at the bearing with the dry seal, to relieve seal tension. Lubricate the U-joint until new grease is seen at the seal, then tighten the capscrews to the above specifications, and bend the tabs of the lockstrap against a flat side of each capscrew head. If the bearing will not take grease, replace the U-joint.

For U-joint replacement, follow the procedure in **Group 41** of the *Heavy-Duty Trucks Service Manual*.

3. Check the purged grease. If it appears rusty, gritty, or burned, replace the U-joint.
4. Wipe the purged grease from the seals, and any excess grease from the grease fitting.

Slip Joint Spline Lubricating

1. Wipe all old grease and dirt from the slip joint grease fitting. See **Fig. 5**, Ref. 1.
2. Use a hand-type grease gun or a high-pressure gun with a low-pressure adapter, to lubricate the slip joint. Add multipurpose chassis grease (lithium 12-hydroxy stearate, NLGI grade 1 or grade 2, with EP additives) until it appears at the pressure-relief hole in the yoke plug. Then cover the relief hole with your finger, while continuing to apply gun pressure until new grease appears at the slip joint seal. See **Fig. 5**. This ensures complete lubrication of the splines.
3. Wipe the purged grease from the pressure-relief hole and slip joint seal, and any excess grease from the grease fitting.

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Alcohol Evaporator Checking	42–07
Anchorlok Aftercooler Automatic Ejector Valve Clearing	42–15
Bendix Air Brake Valve Disassembly, Cleaning, Inspecting, and Lubricating (DV–2, PP–3, and Single Check Valve)	42–18
Bendix Air Brake Valve Disassembly, Cleaning, and Inspecting (BP–1, Double Check Valve, E–6, PP–7, QR–1, R–6, R–14, SR–1, ST–3, TC–7, TP–5, and TR–3)	42–17
Bendix Air Brake Valve Inspecting and Testing (BP–1, BP–R1, LQ–5, PP–7, R–14, and TC–7)	42–19
Bendix Air Brake Valve Operation Checking (BP–R1 and E–12)	42–16
Bendix Air Dryer Checking (AD–2, AD–4, or AD–9)	42–10
Bendix Air Dryer Desiccant Replacing (AD–2)	42–12
Bendix Air Dryer Desiccant Replacing (AD–4 or AD–9)	42–13
Bendix Air Dryer or Anchorlok Aftercooler Inspecting (Bendix AD–2, AD–4, AD–9, or Anchorlok)	42–11
Bendix Alcohol Evaporator Cleaning	42–08
Bendix Alcohol Evaporator Gasket Replacing	42–09
Bendix Foot Brake Valve Actuator Lubricating (E–6 or E–12) and Leak-Testing (E–12)	42–20
Brake Adjusting—Cam Brakes With Manual Slack Adjusters	42–01
Brake Inspection	42–24
CR Brakemaster Air Dryer Cleaning (Model 62 or 68)	42–14
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Manual/Automatic Slack Adjuster Lubricating and Checking (All Models)	42–03
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Meritor WABCO System Saver 1000 Air Dryer Desiccant Replacing	42–23
Midland Quick Release and Flipper Valve Checking	42–22
Sealco Moisture Ejection Valve Operation- and Leak-Testing (Model 6300)	42–21
Wedge Brake Checking	42–05
Wedge Brake Inspecting and Lubricating	42–06

42–01 Brake Adjusting—Cam Brakes With Manual Slack Adjusters

Meritor Brakes

1. Adjust Meritor brakes whenever the brake chamber piston rod applied stroke equals or exceeds the maximum allowable stroke shown in **Table 1**.

Maximum Allowable Brake Chamber Stroke, with Meritor Cam Brakes	
Chamber Size Effective Area: square inches	**Maximum Allowable Stroke*: inches (mm)**
12	1-1/2 (38)
16	1-3/4 (44)
20	1-3/4 (44)
24	1-3/4 (44)
24 (long stroke)	2 (51)
30	2 (51)

* Adjust the brakes whenever the applied stroke exceeds the maximum.

Table 1, Maximum Allowable Brake Chamber Stroke, with Meritor Cam Brakes

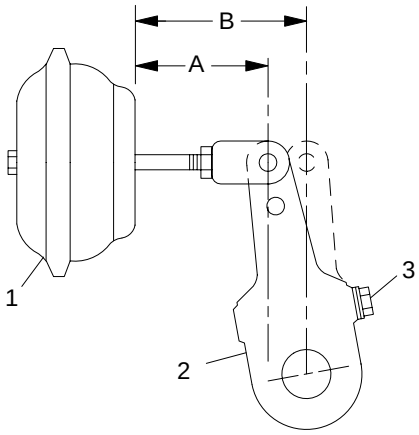
1.1 With the brakes released, measure the distance from the face of the air chamber to the centerline of the clevis pin (**Fig. 1**, Ref. A). Record the exact distance as measurement A.

1.2 Apply the service brakes and hold them on full line pressure of at least 80 psi (550 kPa). Measure the distance from the face of the brake chamber to the centerline of the clevis pin (**Fig. 1**, Ref. B). Record the exact distance as measurement B.

1.3 Subtract measurement A from measurement B to determine the applied stroke.

2. Compare this value to the maximum allowable stroke value in **Table 1**. If the applied stroke equals or exceeds the maximum allowable stroke, adjust the brakes.

2.1 Wipe clean the adjusting screw hexhead. See **Fig. 1**. Place a wrench or socket over the adjusting screw hexhead.



A. With the brakes released, measure this distance.
B. With the brakes applied, measure this distance.
1. Brake Chamber
2. Manual Slack Adjuster (typical)
3. Adjusting Screw

Fig. 1, Measuring Brake Adjustment

IMPORTANT: On slack adjusters with an adjusting screw locking sleeve, wipe clean the locking sleeve area, and depress the locking sleeve when placing the wrench or socket over the adjusting screw. Do not attempt to turn the adjusting screw without fully depressing the locking sleeve.

2.2 Turn the adjusting screw until it is tight, then back off the adjustment until the drum is free. Normally, the adjusting screw will need to be backed off 2 or 3 clicks.

NOTE: Check brake adjustment with the wheel on the ground. Checking brake adjustment when the wheel is off the ground may be unreliable. Looseness or wear in wheel bearings will cause the drum to be misaligned while the wheel is off the ground.

2.3 To determine if the brake drum is free, strike the drum with a steel tool and listen for a clear ringing sound. If a dull thud is heard, the brake is dragging and further adjustment is needed.

IMPORTANT: On slack adjusters with an adjusting screw locking sleeve, after adjust-

ment, make sure the locking sleeve is engaged around the adjusting screw hexhead to lock the adjusting screw in place.

Eaton Brakes

1. Adjust Eaton brakes when either the brake chamber piston rod applied stroke or free stroke equals or exceeds those values in **Table 2**.

Brake Chamber Stroke, with Eaton Cam Brakes		
Chamber Size Effective Area: square inches	**Maximum Allowable Stroke*: inches (mm)**	**Desired Free Stroke: inches (mm)**
12	1-3/8 (35)	3/8 to 1/2 (10 to 13)
16	1-3/4 (44)	3/8 to 1/2 (10 to 13)
20	1-3/4 (44)	3/8 to 1/2 (10 to 13)
24	1-3/4 (44)	3/8 to 5/8 (10 to 16)
24 (long stroke)	2 (51)	3/8 to 5/8 (10 to 16)
30	2 (51)	3/8 to 5/8 (10 to 16)

* Adjust the brakes whenever the applied stroke exceeds the maximum.

Table 2, Brake Chamber Stroke, with Eaton Cam Brakes

1.1 With the brakes released, measure the distance from the face of the air chamber to the centerline of the clevis pin (**Fig. 1**, Ref. A). Record the exact distance as measurement A. To be allowable, measurement A must be within this range: 2-9/16 to 2-11/16 inches (65 to 68 mm).

NOTE: If measurement A is outside this range, reposition the clevis. Remove the clevis pin, loosen the clevis jam nut, and turn the clevis in or out until measurement A is within the specified range. Then install the clevis pin and tighten the clevis jam nut.

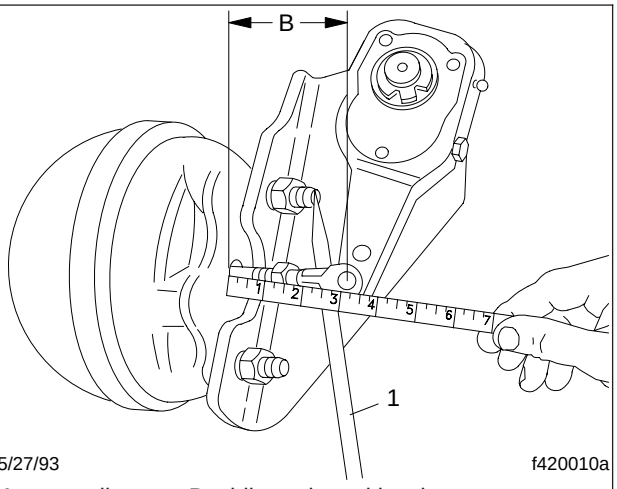
1.2 Apply the service brakes and hold them on full line pressure of at least 80 psi (550 kPa). Measure the distance from the face of the brake chamber to the centerline of the clevis pin (**Fig. 1**, Ref. B). Record the exact distance as measurement B.

1.3 Subtract measurement A from measurement B to determine the applied stroke.

2. Compare this value to the maximum allowable stroke value in **Table 2**. If the applied stroke equals or exceeds the maximum allowable stroke, check the piston rod free stroke.

2.1 With the brakes released, measure the distance from the face of the air chamber to the centerline of the clevis pin (**Fig. 1**, Ref. A). Record the exact distance as measurement A.

2.2 Using a lever as shown in **Fig. 2**, move the slack adjuster piston rod until the brake shoes contact the drum. Measure the distance from the face of the brake chamber to the centerline of the clevis pin (**Fig. 2**, Ref. B). Record the exact distance as measurement B.



Measure distance B while prying with a lever.

1. Lever

Fig. 2

2.3 Subtract measurement A from measurement B to determine the free stroke.

3. Compare this value to the desired free stroke value in **Table 2**. If the free stroke equals or exceeds this range, adjust the brakes.

3.1 Wipe clean the adjusting screw hexhead. See **Fig. 1**. Position a wrench or socket over the adjusting screw hexhead.

IMPORTANT: On slack adjusters equipped with an adjusting screw locking sleeve, wipe clean the locking sleeve area, and depress the locking sleeve when positioning the

wrench or socket over the adjusting screw. Do not attempt to turn the adjusting screw without fully depressing the locking sleeve.

3.2 Turn the adjusting screw until it is tight; then back off the adjustment until the drum is free. Normally, the adjusting screw will need to be backed off 2 or 3 clicks.

NOTE: Check brake adjustment with the wheel on the ground. Checking brake adjustment with the wheel off the ground may prove to be unreliable. Looseness or wear anywhere in the wheel bearings will cause the drum to be misaligned while the wheel is off the ground.

3.3 To see if the drum is free, strike the brake drum with a steel tool and listen for a clear ringing sound. If a dull thud is heard, the brake is dragging and further adjustment is needed.

4. Check the free stroke again to verify that it is within the desired range.

IMPORTANT: On slack adjusters equipped with an adjusting screw locking sleeve, after adjustment, make sure that the locking sleeve is engaged around the adjusting screw hexhead to lock the adjusting screw in place.

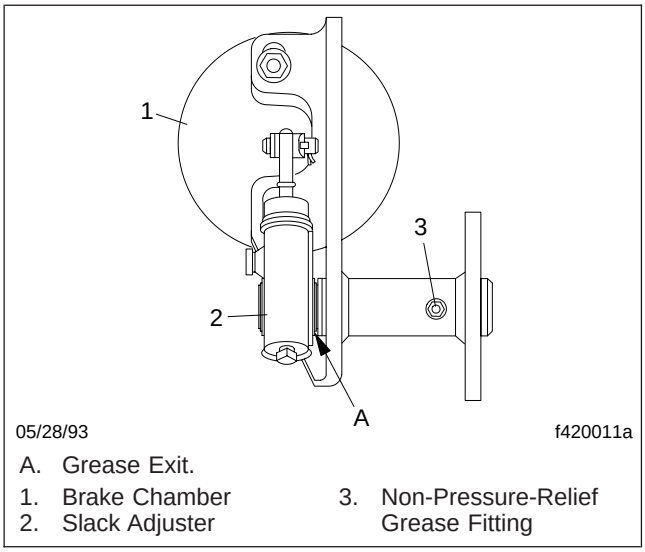
42–02 Camshaft Bracket Bushing Lubricating

IMPORTANT: Perform **MOP 42–24** before lubricating the camshaft bracket.

Pump grease into the camshaft bracket until it appears at the slack adjuster end of the bracket. See **Fig. 3**. Multipurpose chassis grease is recommended, NLGI Grade 1 (6% 12-hydroxy lithium stearate grease) or NLGI Grade 2 (8% 12-hydroxy lithium stearate grease). Be careful that no grease enters the drum cavity. If grease leaks out under the cam head, the camshaft grease seal is worn or damaged, or is installed backwards.

NOTE: Use of meter-type fittings, which have a maximum 40 psi (275 kPa) pressure relief at shutoff, is recommended.

Camshaft brackets without grease fittings are fitted with special seals and packed with extended-lubrication-interval chassis grease. Grease them only when the camshaft is disassembled for servicing.



A. Grease Exit.
1. Brake Chamber
2. Slack Adjuster
3. Non-Pressure-Relief Grease Fitting

Fig. 3, Camshaft Bracket Bushing Lubrication

42–03 Manual/Automatic Slack Adjuster Lubricating and Checking (All Models)

IMPORTANT: Perform **MOP 42–24** before lubricating the slack adjusters.

Bendix or Sloan Manual Slack Adjuster Lubricating

Lubricate the slack adjuster with multipurpose chassis grease (NLGI Grade 1 or 2). Apply enough grease to completely fill the body cavity.

Brunner or Midland Manual Slack Adjuster Lubricating

Brunner and Midland slack adjusters are greased for life at assembly. However, a grease fitting is furnished to permit optional lubrication.

Haldex (SAB) Automatic Slack Adjuster Lubricating and Checking

NOTE: Under normal operating conditions, do not exceed recommended lubrication intervals. Under severe or adverse operating conditions, lubricate more often.

1. At –20°F (–29°C) and above, lubricate the slack adjusters with any extreme-pressure NLGI Grade 1 or 2 grease, such as Esso Lidoc EP2, Shell Darina No. 1, Texaco Thermotex EP1, or Sunaplex No. 1 EP. Below–20°F(–29°C) use Texaco Low Temp EP or an equivalent.

⚠ WARNING

Manually adjusting an automatic slack adjuster to bring the pushrod stroke within legal limits is likely masking a mechanical problem. Adjustment is not repairing. Before adjusting an automatic slack adjuster, troubleshoot the foundation brake system and inspect it for worn or damaged components. Improperly maintaining the vehicle braking system may lead to brake failure, resulting in property damage, personal injury, or death.

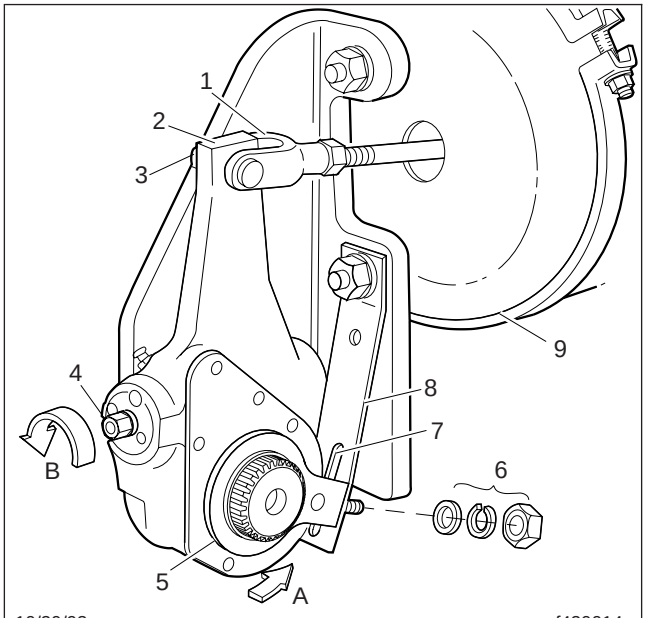
2. Inspect each slack adjuster and anchor strap assembly for damage. See **Fig. 4**. Replace any damaged parts.
3. Check that the control-arm nut is tightened 10 to 15 lbf·ft (14 to 20 N·m).
4. If the control arm is in the wrong position, the brakes will drag. Verify that the control arm is in its full-release position.

   4.1 Chock the rear tires, then release the parking brakes.

   4.2 Remove the clevis pin.

   4.3 With your finger, lightly push the slack adjuster *into* the clevis, then release it. The adjuster may move slightly due to springing of the anchor strap, but will return to its original position (holes in the adjuster and the clevis will remain in alignment). This shows that the control arm is fully released.

   4.4 If the control arm is fully released, install the clevis pin and go to the next step.



A. Rotate the control arm toward the brake chamber until you can feel it contacting the internal stop.
B. Rotate the adjusting nut counterclockwise to increase brake shoe clearance.

1. Clevis
2. Slack Adjuster
3. Clevis Pin
4. Manual Adjusting Nut
5. Control Arm
6. Control-Arm Washers and Nut
7. Anchor Strap Slot
8. Anchor Strap
9. Brake Chamber

Fig. 4, Haldex (SAB) Automatic Slack Adjuster

If the holes in the adjuster and the clevis do not remain aligned, it means the control arm is not against the internal body stop. This indicates an incorrect installation. Move the adjuster into alignment with the clevis hole, and install the clevis pin. Loosen the control-arm nut, and rotate the control arm toward the brake chamber until you can feel it contacting the internal stop (see arrow A in **Fig. 4**). Be sure the control-arm stud moves freely in the slot of the anchor strap.

⚠ CAUTION

Do not hammer on the control arm. This may cause internal damage.

4.5 Tighten the control-arm nut 10 to 15 lbf·ft (14 to 20 N·m).

4.6 Repeat this step to be certain that the control arm is fully released. Final operating travel is obtained after the vehicle has been driven and the brakes are heated.

NOTE: Brake shoe clearance can be increased for inspection or brake system servicing by turning the manual adjusting nut counterclockwise (see arrow B in **Fig. 4**). Turning it in that direction takes considerable effort and may be accompanied by a ratcheting sound.

Meritor Automatic Slack Adjuster Lubricating and Checking

⚠ WARNING

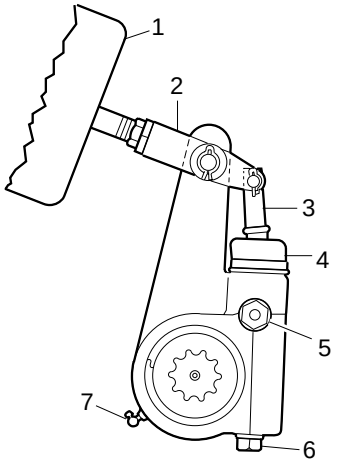
Manually adjusting an automatic slack adjuster to bring the pushrod stroke within legal limits is likely masking a mechanical problem. Adjustment is not repairing. Before adjusting an automatic slack adjuster, troubleshoot the foundation brake system and inspect it for worn or damaged components. Improperly maintaining the vehicle braking system may lead to brake failure, resulting in property damage, personal injury, or death.

1. Lubricate the slack adjuster using high-temperature, waterproof grease, NLGI Grade 1, such as Texaco Thermotex EP No. 1, Shell Darina No. 1, Marathon 528 heavy-duty, Sunaplex No. 1 EP, Amdex No. 1 EP, or Philube B No. 1. It should be smooth-textured, corrosion-resistant grease, free of fillers and abrasives. Lubricate the slack adjuster through the grease fitting (**Fig. 5**, Ref. 7) until grease is forced out past the pressure-relief capscrew (Ref. 5), or past the gear splines around the inboard snap ring.
2. Check the boot for cuts, tears, or other damage. Replace it if necessary.

Gunite Automatic Slack Adjuster Lubricating and Checking

⚠ WARNING

Manually adjusting an automatic slack adjuster to bring the pushrod stroke within legal limits is likely masking a mechanical problem. Adjustment is not repairing. Before adjusting an automatic slack adjuster, troubleshoot the foundation brake system and inspect it for worn or damaged components. Improperly maintaining the vehicle braking system may lead to brake failure, resulting in property damage, personal injury, or death.



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1. Brake Chamber
2. Clevis
3. Actuator Rod
4. Boot
5. Pressure-Relief Capscrew, Gasket, Pawl Spring, and Pawl
6. Manual Adjusting Nut
7. Grease Fitting (or Lube Plug)

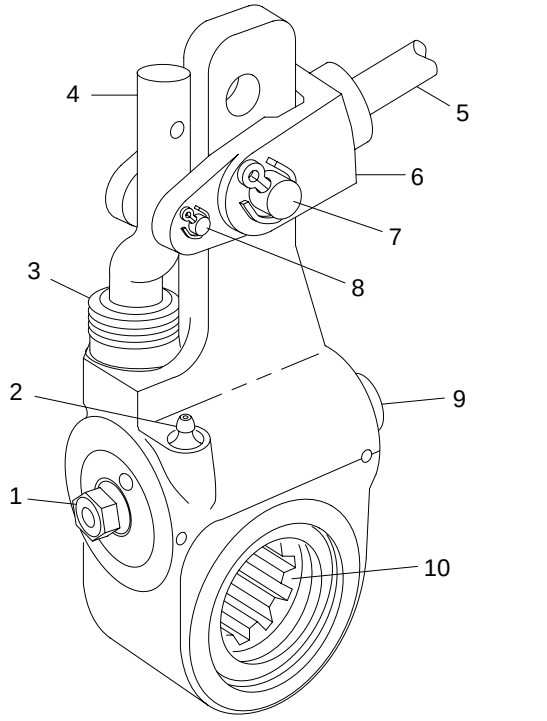
Fig. 5, Meritor Automatic Slack Adjuster

1. Lubricate the slack adjuster until grease flows from the grease relief opening. See **Fig. 6**. For temperatures to –40°F (–40°C), use Lubriplate Aero; for temperatures to –20°F (–29°C), use Texaco Multifak EP–2 or MobilGrease No. 77.

   The newest Gunite slack adjusters are produced without a grease relief. During lubrication with a grease gun, lubricant is forced through the drilled worm wheel onto the camshaft. Lubricate the slack adjuster at the grease fitting until grease appears on the camshaft.
2. Inspect the slack adjuster for structural damage. Replace the slack adjuster if needed.
3. Inspect the slack adjuster boot for cuts or tears.

   If the boot is damaged, replace it as follows (see **Fig. 6**).

   3.1 Remove the two clevis pins.



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1. 7/16-Inch Adjusting Nut
2. Grease Fitting
3. Boot
4. Link
5. Brake Chamber Piston Rod
6. Clevis
7. 1/2-Inch Clevis Pin
8. 1/4-Inch Clevis Pin
9. Grease Relief Opening
10. Slack Adjuster Spline

Fig. 6, Gunite Automatic Slack Adjuster

3.2 Rotate the worm shaft adjusting hexnut counterclockwise to move the link away from the clevis. About 45 lbf·ft (60 N·m) is needed. You will hear a clicking sound.

Remove the old boot from the link.

3.3 Install a new boot on the link, heavy section down. Be careful not to damage the boot.

3.4 Seat the boot so that the bottom of the boot is in the boot insert, and the top is in the groove of the link.

3.5 Rotate the adjusting hexnut clockwise until the 1/4-inch hole in the clevis lines up with the hole in the link.

Install the 1/4-inch clevis pin and the cotter pin.

3.6 Tap the clevis upward or downward until the large hole in the slack adjuster lines up with one in the clevis.

Install the 1/2-inch clevis pin and the cotter pin.

⚠ WARNING

Make sure both clevis pins are installed. Failure to do so will cause the slack adjuster to work incorrectly, which could lead to loss of braking control. This could result in an accident causing personal injury or property damage.

42–04 Meritor Automatic Slack Adjuster Lubricating

IMPORTANT: Perform **MOP 42–24** before lubricating the slack adjusters.

1. Remove the pressure-relief capscrew, pawl spring, and pawl. See **Fig. 5**.
2. Examine the pawl for grease retention and condition. If the grease is in good condition, install the pressure-relief capscrew, pawl spring, and pawl; then tighten the pressure-relief capscrew 15 to 20 lbf·ft (20 to 27 N·m). Lube the slack adjuster through the grease fitting until lubricant is forced out through the pressure-relief fitting (or pawl slot).

   If the grease has hardened, or the pawl is dry and shows extreme wear, remove the slack adjuster. Disassemble and clean it. Inspect the internal parts, install new seals and a new boot when assembling, then install and lubricate the slack adjuster. See **Group 42** of the *Heavy-Duty Trucks Service Manual* for instructions.

42–05 Wedge Brake Checking

1. Check brake shoe lining wear to determine the proper reline time.
2. Check the lining-to-drum clearance. Automatic adjusters are working properly if (for brakes using two parking brake chambers per wheel) clearance at the inspection hole is between

0.010 and 0.060 inch (0.25 and 1.5 mm). If adjusters are not working properly, schedule the vehicle for brake system service. See **Group 42** of the *Heavy-Duty Trucks Service Manual*.

For brakes using one parking brake chamber per wheel, clearance in excess of 0.035 inch (0.9 mm) may require manual adjustment to obtain optimum performance, until the vehicle can be scheduled for service.

The above numbers are established as a guide (to indicate a range) only, and are not precise. Specific situations may differ due to individual component combinations of drums and linings, etc.

3. Check service and parking brake air systems by cycling the respective application valves.

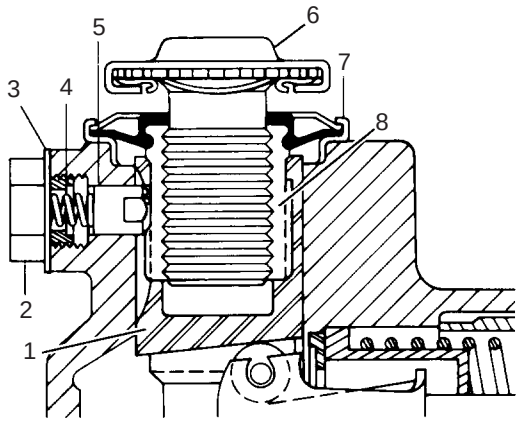
   Check the service brake by actuating the treadle several times. Observe the action to determine if there is correct actuating system function, and correct lining-to-drum contact.

   Check parking brake operation by actuating the control valve on the dashboard of the cab.

42–06 Wedge Brake Inspecting and Lubricating

IMPORTANT: Before inspection, cage all parking brake units manually or by air pressure. See **Group 42** of the *Heavy-Duty Trucks Service Manual* for instructions. Ensure that the emergency brake airline pressure is exhausted before removing the line from the brake chamber.

1. Remove the wheels and brake drums. Refer to the axle section in the service manual for wheel and drum removal instructions and brake lining dust warnings.
2. Inspect the plunger seals. See **Fig. 7**. If seals are cut, torn, or otherwise ineffective, disassemble and overhaul the brake actuating components.
3. Remove the pawl assembly, then remove the adjusting plunger and seal, to check internal condition. If grease is contaminated or hardened, or if parts are dry, disassemble and overhaul the brake actuating components.



1. Adjusting Plunger
2. Hollow Capscrew
3. Gasket
4. Pawl Spring
5. Adjusting Pawl
6. Adjusting Bolt
7. Plunger Seal
8. Adjusting Sleeve

Fig. 7, Wedge Brake Adjusting Components

NOTE: Highly polished parts do not always require replacement. Only components that are scored or show other unusual signs of wear must be replaced.

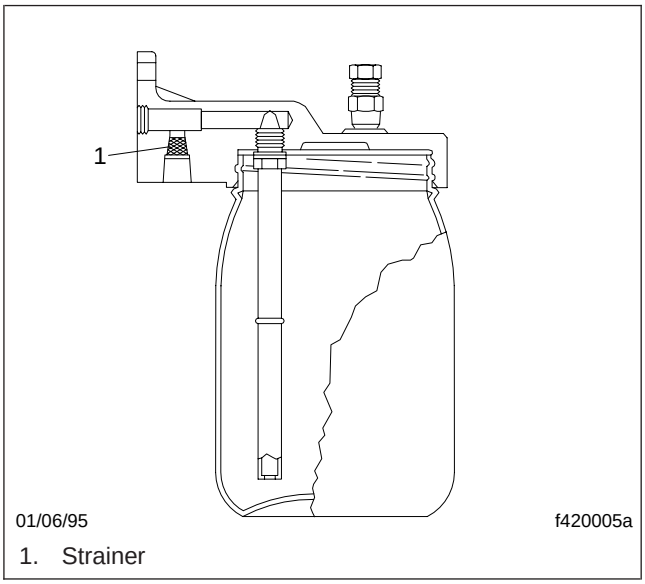
4. Grease the unit using multipurpose chassis grease, NLGI grade 1, such as Texaco Thermotex EP No. 1, Shell Darina No. 1, Marathon 528 heavy-duty, Sunaplex No. 1 EP, Amdex No. 1 EP, or Philube B No. 1. Assemble the adjusting plunger, replace the seal (using an appropriate seal driver), and assemble the pawl. Then, manually adjust the brake to specifications.

42–07 Alcohol Evaporator Checking

Bendix

NOTE: During freezing weather, check the alcohol evaporator weekly.

Check that all fittings are tight, and that bubbles are present in the alcohol when the compressor is compressing. See **Fig. 8**. If the alcohol evaporator is not operating properly, see the troubleshooting guide in **Group 42** of the *Heavy-Duty Trucks Service Manual*.



1. Strainer

Fig. 8, Bendix Alcohol Evaporator (sectional view)

Midland

Maintenance is required during both the freeze season and the off season to keep the alcohol evaporator in good working order.

Off Season

During the off season, drain the unit of alcohol. At regular engine service intervals, open the drain cock to remove moisture from the alcohol evaporator. Before reactivating the evaporator for the next freeze season, drain, disassemble, inspect, and steam-clean the unit of any sludge that may have accumulated. It is advisable to replace any rubber parts when assembling the alcohol evaporator. Perform this service just before the freeze season.

Freeze Season Reactivation

1. Remove the filler cap, and check the cap tetraseal.
2. Remove the capscrews and reservoir from the cover.
3. Remove the cover tetraseal.
4. Drain the air tank, and disconnect the line from the evaporator outlet. Remove the check-valve retainer, spring, and disc.
5. Install the disc, spring, and check-valve retainer, and connect the line to the evaporator outlet.
6. Install the cover tetraseal.
7. Install the reservoir on the cover and tighten the capscrews.
8. Fill the reservoir with 40 ounces (1183 mL) of methyl alcohol, then install the filler cap.

42–08 Bendix Alcohol Evaporator Cleaning

If a strainer is present, check that it is clear. See **Fig. 8**. Clean or replace the strainer if necessary.

42–09 Bendix Alcohol Evaporator Gasket Replacing

Disassemble the evaporator and the check valve (if so equipped). Clean all parts, and replace all gaskets and rubber parts.

42–10 Bendix Air Dryer Checking (AD–2, AD–4, or AD–9)

Bendix AD–2

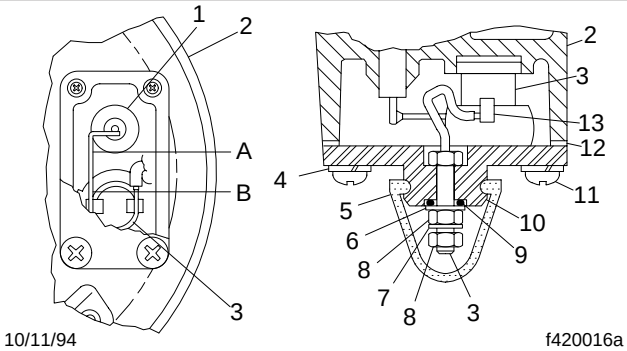
Check operation of the heater and thermostat. This can be done by allowing the end cover assembly to cool below 50°F (10°C), then placing your hand near the end cover when the ignition switch is turned on. The end cover should be warm to the touch within a few minutes. Warming should cease at about 85°F (30°C).

Bendix AD–4

Check the operation of the end cover heater-and-thermostat assembly during cold weather.

1. With the ignition or engine control on, check for power at the dryer's electrical terminal, using a voltmeter or test light. Check between the electrical terminal and the metal end cover. If there is no voltage, look for a blown fuse, broken wires, or corrosion in the vehicle wiring harness.
2. Turn off the ignition switch and cool the end cover assembly to below 40°F (4°C).

3. Using an ohmmeter, check resistance between the electrical terminal and the metal end cover. See **Fig. 9**. Resistance should be 2.0 to 4.0 ohms for a 12-volt/60-watt end cover, and 4.0 to 7.0 ohms for a 24-volt/120-watt end cover.



1. Heater Post
2. Air Dryer End Cover
3. Thermostat/Terminal Assembly
4. Lockwasher
5. Boot
6. Washer
7. Lockwasher
8. Nut
9. O-Ring
10. Thermostat Cover
11. Screw
12. Thermostat Cover Gasket
13. Spacer

Fig. 9, Air Dryer Thermostat Assembly

4. Warm the end cover assembly to over 90°F (32°C) and check resistance as above. Resistance should exceed 1000 ohms.

   If resistance values are within stated limits, the thermostat and heater are operating properly. If resistance values are outside stated limits, proceed to the next step to determine the cause.

5. With the ignition or engine control switch off, remove the thermostat cover. See **Fig. 9**. Using an ohmmeter, check resistance between the metal end cover and the heater post. For a 12-volt/60-watt end cover, resistance should be 2.0 to 2.8 ohms, and for a 24-volt/120-watt end cover, resistance should be 4.0 to 4.6 ohms. If the heater resistance is outside stated limits, install a new or remanufactured end cover.

6. Check that a good ground path exists between the air dryer end cover casting and the vehicle chassis. Correct if needed.

   If the heater resistance is within stated limits, the thermostat is defective. Replace the thermostat (kit number 102657) or install a new or remanufactured end cover.

7. Install the thermostat cover (Ref. 10) as shown in **Fig. 9**; be sure the rubber spacer and gasket are correctly installed.

Bendix AD–9

During cold weather, check operation of the end cover heater-and-thermostat assembly.

1. With the ignition on, check for voltage to the heater-and-thermostat assembly. Unplug the electrical connector at the air dryer, and place a test lead on each pin of the male connector. If there is no voltage, look for a blown fuse, broken wires, or corrosion in the vehicle wiring harness. Check that a good ground path exists.

2. Check thermostat and heater operation. Turn off the ignition switch and cool the end cover assembly to below 40°F (4°C). Using an ohmmeter, check resistance between the electrical pins in the female connector. Resistance should be 1.5 to 3.0 ohms for the 12-volt heater, and 6.8 to 9.0 ohms for the 24-volt heater. Some early models of the AD–9 will have resistance readings of 1.0 to 2.5 ohms for the 12-volt heater, and 4.8 to 7.2 ohms for the 24-volt heater. If resistance is higher than this, replace the purge-valve housing assembly, which includes the heater-and-thermostat assembly.

3. Warm the end cover assembly to over 90°F (32°C) and again check resistance. It should exceed 1000 ohms. If it does, the thermostat-and-heater assembly is operating properly. If it doesn't, replace the purge-valve housing assembly, which includes the heater-and-thermostat assembly.

42–11 Bendix Air Dryer or Anchorlok Aftercooler Inspecting (Bendix AD–2, AD–4, AD–9, or Anchorlok)

Bendix AD–2, AD–4, or AD–9

Check reservoirs for moisture. A small amount (teaspoon or less) is normal. An excess may indicate that desiccant replacement is necessary.

Check the mounting and connecting lines. Make sure that SAE grade 5 fasteners attaching the air dryer to the vehicle are tightened 28 lbf·ft (38 N·m) for 3/8–16 fasteners, and 45 lbf·ft (61 N·m) for 7/16–14 fasteners. Check all air lines, fittings, and electrical connections for damage, leakage, or looseness. Replace damaged or leaking components, and tighten loose fittings and electrical connections.

Anchorlok

Inspect the Anchorlok aftercooler (**Fig. 10**) for loose mountings, cracks, or other damage from external sources. Check for leakage at air fittings, the drain valve, and the automatic ejector valve. Tighten any loose mountings and leaking air fittings. If the tank leaks at cracks or seams, install a new tank using instructions in **Group 42** of the *Heavy-Duty Trucks Service Manual*. To check operation of the automatic ejector valve, start the engine and allow air pressure to build. Watch the automatic ejector valve to make sure it ejects when the air compressor cuts out. If the automatic ejector valve fails to operate, or if it leaks air, service it using instructions in **Group 42** of the *Heavy-Duty Trucks Service Manual*.

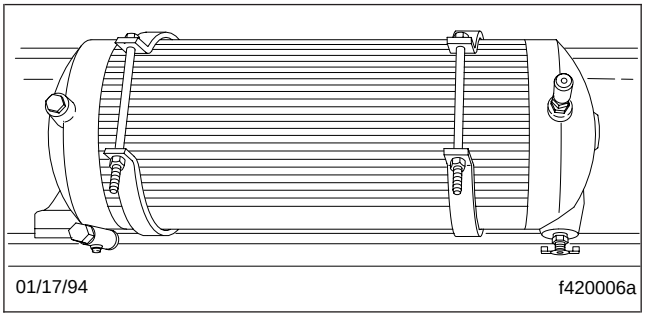


Fig. 10, Anchorlok Aftercooler

42–12 Bendix Air Dryer Desiccant Replacing (AD–2)

Replace or rebuild the desiccant cartridge. For instructions, see **Group 42** of the *Heavy-Duty Trucks Service Manual*.

NOTE: Desiccant change intervals may vary from vehicle to vehicle; however, it is generally recommended that the cartridge be rebuilt or replaced at the interval given in the Maintenance Operations Chart. If experience has shown that extended or shortened life has resulted on a particular installation, then the interval can be increased or decreased accordingly.

42–13 Bendix Air Dryer Desiccant Replacing (AD–4 or AD–9)

Disassemble, clean, and inspect the Bendix air dryer. Replace the desiccant cartridge. See **Group 42** of the *Heavy-Duty Trucks Service Manual* for instructions.

NOTE: Desiccant change intervals may vary from vehicle to vehicle. Although typical desiccant cartridge life is three years, many will perform adequately for a longer period of time. To take maximum advantage of desiccant life and assure that replacement occurs only when necessary, it is important to perform the other maintenance operations in this group.

42–14 CR Brakemaster Air Dryer Cleaning (Model 62 or 68)

Thoroughly steam-clean the cooling fins of the CR Brakemaster air dryer to remove road grime. Check that the cooling fins have not been painted; if so, remove the paint.

42–15 Anchorlok Aftercooler Automatic Ejector Valve Clearing

Remove the 1/8-inch pipe plug from the bottom of the automatic ejector valve. Cycle the air compressor three or four times, to blow out any moisture build-up in the valve and to ensure that lines to the valve are clear. Install and tighten the pipe plug 10 to 12 lbf·ft (14 to 16 N·m).

42–16 Bendix Air Brake Valve Operation Checking (BP–R1 and E–12)

Check for proper operation; see **Group 42** of the *Heavy-Duty Trucks Service Manual* for instructions.

42–17 Bendix Air Brake Valve Disassembly, Cleaning, and Inspecting (BP–1, Double Check Valve, E–6, PP–7, QR–1, R–6, R–14, SR–1, ST–3, TC–7, TP–5, and TR–3)

NOTE: See **Group 42** of the *Heavy-Duty Trucks Service Manual* for valve removal, disassembly, inspection, assembly, and leakage-checking instructions.

Remove and disassemble the valves.

Clean the valve parts with mineral spirits, and inspect the parts. Replace all rubber parts and any worn or damaged parts; use only genuine Bendix replacement parts or kits.

Assemble and install the valves, then check for proper operation and for leakage.

42–18 Bendix Air Brake Valve Disassembly, Cleaning, Inspecting, and Lubricating (DV–2, PP–3, and Single Check Valve)

NOTE: See **Group 42** of the *Heavy-Duty Trucks Service Manual* for valve removal, disassembly, inspection, assembly, and leakage-checking instructions.

Remove and disassemble the valves.

Clean the valve parts with mineral spirits, and inspect the parts. Replace all rubber parts and any worn or damaged parts; use only genuine Bendix replacement parts or kits.

For a DV–2 valve, lubricate the air reservoir automatic drain valve. If there is a filter screen in the adaptor fitting, replace it with a new one.

Assemble and install the valves, then check for proper operation and for leakage.

42–19 Bendix Air Brake Valve Inspecting and Testing (BP–1, BP–R1, LQ–5, PP–7, R–14, and TC–7)

1. Clean the exterior of the valves, and check them for corrosion and damage.
2. Inspect the air lines connected to the valves for signs of wear or damage. Replace the lines as needed.
3. Test the air line fittings for excessive leakage. Tighten or replace the fittings as needed.
4. Check the valves for leakage. See **Group 42** of the *Heavy-Duty Trucks Service Manual* for instructions.

   For BP–1, LQ–5, PP–7, R–14, and TC–7 valves, check for proper operation. See **Group 42** of the *Heavy-Duty Trucks Service Manual* for instructions.

42–20 Bendix Foot Brake Valve Actuator Lubricating (E–6 or E–12) and Leak-Testing (E–12)

FLA or FLB

1. Clean any dirt, gravel, and other foreign material from the base of the brake pedal, the plunger boot, and the brake base bracket.
2. Use light oil to lubricate the brake pedal roller and roller pin.
3. Check the brake plunger boot for cracks, holes, or deterioration. Replace if necessary.

4. Lift the edge of the brake plunger boot and check the plunger for existing lubrication.

   If the plunger is dry, remove it by removing the brake pedal and brake plunger boot. Lubricate the plunger and inside surface of the boot with barium grease, part number BW 246671, or Pennzoil Adhezoplex EP 2; *use only these approved lubricants*. Install the plunger, boot, and brake pedal.

   If the plunger has grease on it, lift the edge of the brake plunger boot enough to apply 2 to 4 drops of light oil around the brake plunger, where it slides into the brake base bracket. Reinstall the plunger boot around the brake base bracket.

FLC

1. Clean any dirt, gravel, and other foreign material from the plunger boot and brake base bracket.
2. Check the brake plunger boot for cracks, holes, or deterioration. Replace if necessary.
3. Lift the edge of the brake plunger boot and check the plunger for existing lubrication.

   If the plunger is dry, remove it by removing the cotter pin and clevis pin, and pulling the clevis pin out. Remove the piston rod and boot. Lift out the plunger. Lubricate the plunger and the tip of the piston rod with barium grease, part number BW 246671, or Pennzoil Adhezoplex EP 2; *use only these approved lubricants*. Install the piston rod, boot, clevis pin, and cotter pin.

   If the plunger has grease on it, lift the edge of the brake plunger boot enough to apply 2 to 4 drops of light oil around the brake plunger; do not over-oil. Install the plunger boot.
4. Lubricate the clevis pin with light oil.
5. For E–12 valves, check for leakage; see **Group 42** of the *Heavy-Duty Trucks Service Manual* for instructions.

FLD

NOTE: You may need to remove tie straps and an air line to gain access to the valve bore. It should not be necessary to remove the adaptor from the valve.

1. Remove the three mounting bolts that hold the foot brake valve on the firewall.
2. From outside the cab, pull the valve away from the firewall; then remove the brake valve mounting adaptor and plunger. See **Group 42** of the *Heavy-Duty Trucks Service Manual* for instructions.
3. Thoroughly clean any grease and contaminants from the brake valve mounting adaptor bore and the plunger surface.
4. Inspect the adaptor bore and the plunger sliding surface for corrosion. The bore and plunger surfaces should be smooth, with no pitting or roughness. Some discoloration is permissible. If there is pitting roughness, replace with new parts. See **Table 3**.
5. Apply one of the specified silicone greases to the sliding surfaces of the plunger and the adaptor bore. See **Table 4**. If installing a new adaptor or plunger, first apply the grease included with the kit.
6. Install the brake valve mounting adaptor and plunger, using a new gasket.

E-6 and E-12 Brake Valve Service Parts List		
Description	**Part Number**	**Qty.**
Valve Adaptor	BW 5002378	1
Plunger	BW 5002379	1
Gasket	12—15695—000	1

Table 3, E-6 and E-12 Foot Brake Valve Service Parts List

Silicone Greases		
Description	**Manufacturer**	**Source**
BW 291126 (silicone base grease spec.BW–650–M) 3.7 cc packet*	Allied Signal	PDC
55 O-RIng Lubricant (Formerly Molykote DC–55M Pneumatic Grease)	Dow-Corning Corporation	Locally
V–755 O-Ring Lubricant	Rhone-Poulenc Silicone VSI Inc.	Locally

* Each 3.7 cc packet is adequate to lubricate one foot valve adaptor assembly.

Table 4, Silicone Greases

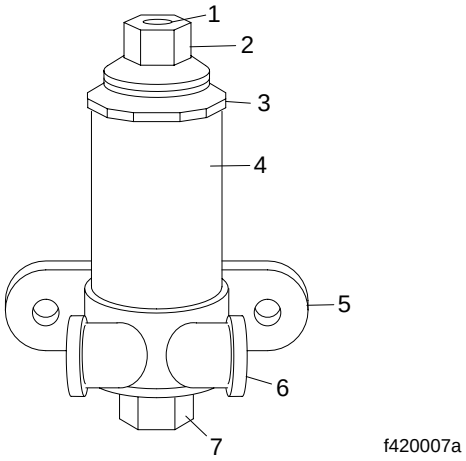
42–21 Sealco Moisture Ejection Valve Operation- and Leak-Testing (Model 6300)

Operation-Testing

⚠ WARNING

Keep away from the front of the moisture ejection valve exhaust outlet because moisture, scale, or other debris will be ejected with force when the compressor is cycled. Use eye protection such as safety glasses when checking the moisture ejection valve to prevent harm to your eyes from flying debris.

When the moisture ejection valve is plumbed to the governor unloader, an exhaust of air/sludge will occur only when the air compressor starts or stops pumping air. With the air system charged, cycle the brake foot valve until the air compressor starts pumping air. Notice if an exhaust of air/sludge occurs at the exhaust outlet of the moisture ejection valve (**Fig. 11**) when the air compressor starts pumping (cuts in) or stops pumping (cuts out).



1. Reservoir Inlet
2. Upper Cap
3. Guide Post
4. Column
5. Body Casting
6. Application Line
7. Exhaust Outlet

Fig. 11, Sealco 6300 Moisture Ejection Valve

If there is no discharge, repair or replace the moisture ejection valve; for instructions, see **Group 42** of the *Heavy-Duty Trucks Service Manual*.

Check the valve again for operation. Repeat the instructions under this heading until the valve operates as specified. If the valve fails to operate properly, install a new one.

Leak-Testing

For leak-testing instructions, see **Group 42** of the *Heavy-Duty Trucks Service Manual*.

42–22 Midland Quick Release and Flipper Valve Checking

1. Chock the tires.
2. Start the engine and run it long enough to pressurize the air system to at least 80 psi (550 kPa), then turn off the engine. Repeat as needed, to maintain 80 psi (550 kPa) pressure during these checks.
3. Clean off road grime from the valves, and any material from all valve exhaust ports.
4. Listen for air leakage around fittings and exhaust ports. Tighten the fittings as needed; use two wrenches to avoid twisting the tubing.

   If any valve fails this check, or is damaged, repair or replace it. Refer to the Midland service manual for instructions.
5. Remove the chocks from the tires.

42–23 Meritor WABCO System Saver 1000 Air Dryer Desiccant Replacing

Replace the desiccant cartridge. For instructions, see **Group 42** of the *Heavy-Duty Trucks Service Manual*.

NOTE: Desiccant change intervals may vary from vehicle to vehicle. Typical desiccant cartridge life is three years. However, if experience has shown that extended or shortened life has

resulted on a particular installation, then the interval can be increased or decreased accordingly.

42–24 Brake Inspection

IMPORTANT: This procedure should be performed prior to lubrication of the brake components.

Parking Brake Operational Check

⚠ CAUTION

Perform the following check in a clear safe area. If the parking brakes fail to hold the vehicle, personal injury or property damage may result.

1. With the engine running, and air pressure at cut-out pressure, set the parking brake.
2. Put the vehicle in the lowest gear and gently attempt to move it forward. The vehicle should not move. If the vehicle moves, the parking brakes are not operating correctly and must be repaired before the vehicle is returned to service. See **Group 42** of the *Heavy-Duty Trucks Service Manual* for repair procedures.

Brake Component Inspection

1. Park the vehicle on a level surface, set the parking brake, and chock the tires. Once the tires are chocked, release the parking brake.

⚠ WARNING

Manually adjusting an automatic slack adjuster to bring the pushrod stroke within legal limits is likely masking a mechanical problem. Adjustment is not repairing. Before adjusting an automatic slack adjuster, troubleshoot the foundation brake system and inspect it for worn or damaged components. Improperly maintaining the vehicle braking system may lead to brake failure, resulting in property damage, personal injury, or death.

2. With the engine off, and 100 psi (689 kPa) of air tank pressure, have an assistant apply and hold an 80 to 90 psi (550 to 620 kPa) brake application.
3. Check to see if the colored over-stroke band on each brake chamber pushrod is exposed.

   If a band shows, the stroke is too long. Check the foundation brake components for wear or damage, and repair as needed. See **Group 42** of the *Heavy-Duty Trucks Service Manual* for inspection, troubleshooting, and repair procedures.
4. Measure the applied chamber stroke. See **Table 5** for the proper stroke for the type of chamber being used. If the stroke is too short, the brakes may drag or will not fully apply. Check for improper operation or adjustment of the automatic slack adjuster. See **Group 42** of the *Heavy-Duty Trucks Service Manual* for inspection and troubleshooting procedures.
5. Start the engine and build air pressure to at least 100 psi (689 kPa). Shut down the engine.
6. Check all of the foundation brake components for damage, wear, and loose or missing parts. Repair as needed. See **Group 42** of the *Heavy-Duty Trucks Service Manual* for repair procedures.

Brake Chamber Stroke Specifications			
Chamber			Max Applied Stroke: inch (mm)
Manufacturer	Type*	Size†	
Gunite	Standard Stroke	9	1-3/8 (35)
		12	
		16	1-3/4 (44)
		20	
		24	
		30	2 (51)
		36‡	2-1/4 (57)
	Long Stroke	16	2 (51)
		20	
		24 (2-1/2 inch rated stroke)	
		24 (3 inch rated stroke)	2-1/2 (64)
		30	
Haldex	Standard Stroke	12	1-3/8 (35)
		16	1-3/4 (44)
		20	
		24	
	2-1/2-Inch Extended Stroke	24	2 (51)
	3-Inch Extended Stroke	24	2-1/2 (64)
	Standard Stroke	30	2 (51)
	Long Stroke	30	2-1/2 (64)
Meritor	Standard Stroke	9	Less than 1-1/2 (38)
		12	
		16	Less than 1-3/4 (44)
		20	
		24	Less than 1-7/8 (48)
	Long Stroke	24	Less than 2 (51)
	Standard Stroke	30	

* Long stroke design is indicated by a tag, or embossing, on the brake chamber.

† Specifications are relative to a brake application with 80 to 90 psi (550 to 620 kPa) air pressure in the brake chambers.

‡ If type 36 chamber is used, slack length should be less than 6 inches.

Table 5, Brake Chamber Stroke Specifications

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Drag Link and Power Steering Cylinder Lubricating	46–04
Power Steering Reservoir Fluid Level Checking	46–05
Power Steering Reservoir Fluid and Filter Changing	46–06
Sheppard Power Steering Gear Bearing Cap Lubricating	46–09
Steering Driveline Deck Bearing Lubricating, FLA/FLB	46–07
Steering Driveline Lubricating	46–01
TRW Manual Steering Gear Lubricant Changing, Model 503	46–03
TRW Manual Steering Gear Lubricant Checking, Model 503	46–02
TRW Power Steering Gear Lubricating, TAS Series	46–08

46–01 Steering Driveline Lubricating

Wipe the steering driveline grease fittings clean. See **Fig. 1**, **Fig. 2**, **Fig. 3**, and **Fig. 4**. Using a pressure gun, apply multipurpose chassis grease sparingly to the universal joints and slip-joint splines. For an FLA or an FLB, lubricate the slip-joint splines only when the cab is in the operating position. Turn the front wheels to the left for better access to the driveline.

46–02 TRW Manual Steering Gear Lubricant Checking, Model 503

1. Remove the fill plug from the top of the steering gear housing. See **Fig. 4**.

⚠ WARNING

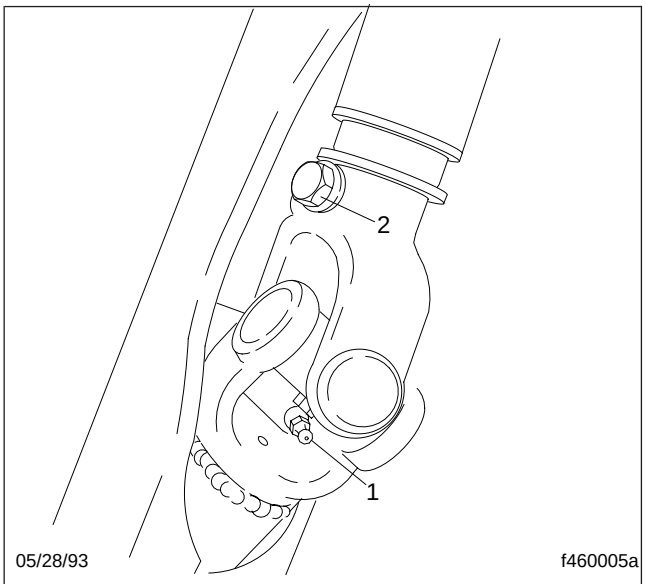
Use only an approved lubricant. Failure to add approved lubricant could adversely affect steering ease under certain conditions and could hamper vehicle control. This could lead to an accident resulting in injury or property damage.

2. Check the lubricant level. If low, add enough lubricant to bring the level to within 1/2 inch (13 mm) of the fill hole. Use hypoid gear oil API service classification GL–5 (with no zinc additive). At operating temperatures continuously above 30°F (–1°C) use viscosity grade SAE 90. At operating temperatures continuously below 30°F (–1°C) use viscosity grade SAE 75.
3. Install and tighten the fill plug 14 lbf·ft (19 N·m).

46–03 TRW Manual Steering Gear Lubricant Changing, Model 503

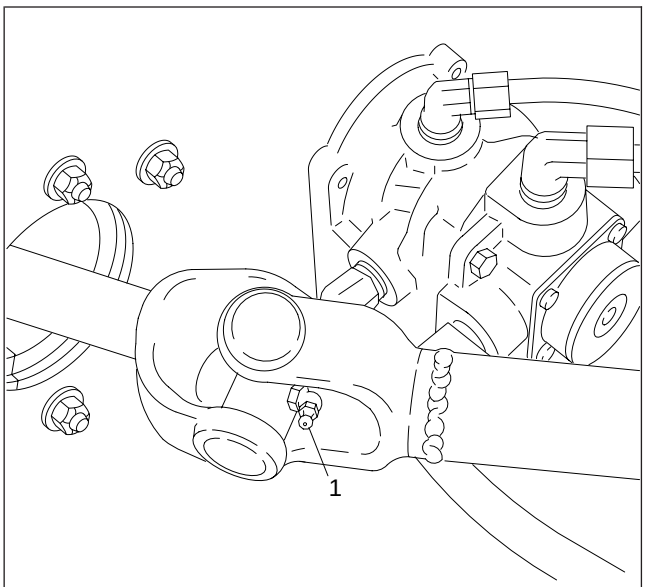
NOTE: In climates with extreme temperature changes, lubricant should be changed every six months.

1. While the steering gear lubricant is still warm, remove the steering gear drain plug and drain the old lubricant. Lubricant will drain faster if the fill plug is also removed. See **Fig. 4**. After all lubricant has drained, install and tighten the drain plug 14 lbf·ft (19 N·m).



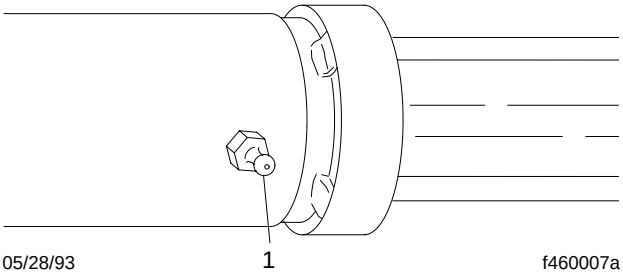
1. U-Joint Grease Fitting
2. Steering Column End Yoke Pinch Bolt and Nut

Fig. 1, Steering Driveline Upper Universal Joint



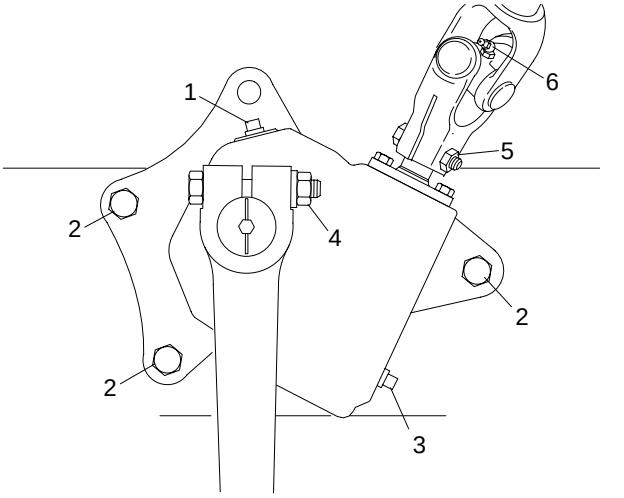
1. Intermediate Shaft U-Joint Grease Fitting

Fig. 2, Steering Driveline Intermediate Universal Joint



1. Slip Joint Grease Fitting

Fig. 3, Steering Driveline Slip Joint



1. Fill Plug
2. Steering Gear Attachment Fasteners
3. Drain Plug
4. Pitman Arm Pinch Bolt and Nut
5. Input Shaft End Yoke Pinch Bolt and Nut
6. Input Shaft End Yoke U-Joint Grease Fitting

Fig. 4, TRW Model 503 Manual Steering Gear

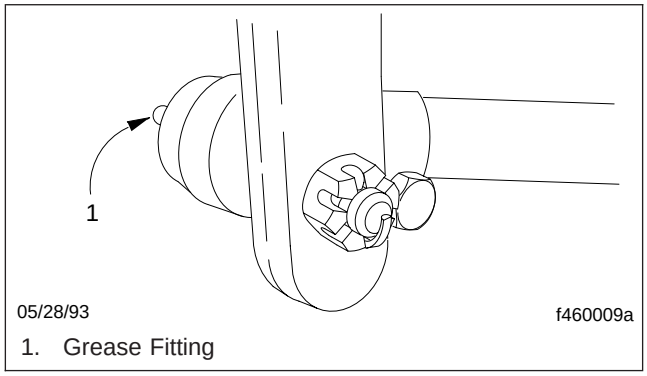
⚠ WARNING

Use only an approved lubricant. Failure to fill the steering gear with approved lubricant could adversely affect steering ease under certain conditions and could hamper vehicle control. This could lead to an accident resulting in injury or property damage.

2. Fill the steering gear with clean lubricant to within 1/2 inch (13 mm) of the fill hole. Use hypoid gear oil API service classification GL–5 (with no zinc additive). At operating temperatures continuously above 30°F (–1°C) use viscosity grade SAE 90. At operating temperatures continuously below 30°F (–1°C) use viscosity grade SAE 75.
3. Install and tighten the fill plug 14 lbf·ft (19 N·m).

46–04 Drag Link and Power Steering Cylinder Lubricating

1. Using a clean rag, wipe all dirt from both drag link grease fittings, and if so equipped, both power steering cylinder grease fittings. See **Fig. 5**, **Fig. 6**, and **Fig. 7**.



1. Grease Fitting

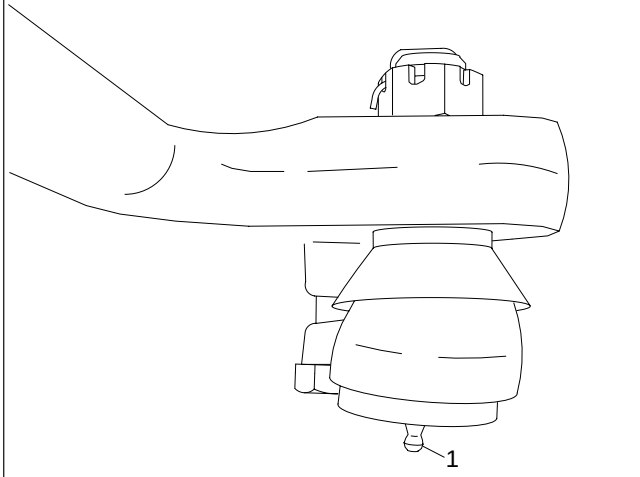
Fig. 5, Drag Link (pitman arm end)

2. Using a pressure gun, apply clean grease at the grease fittings until old grease is forced out of the socket. Use multipurpose chassis grease NLGI grade 2 (8% 12-hydroxy lithium stearate grease) or NLGI grade 1 (6% 12-hydroxy lithium stearate grease). Grade 2 is preferred.

46–05 Power Steering Reservoir Fluid Level Checking

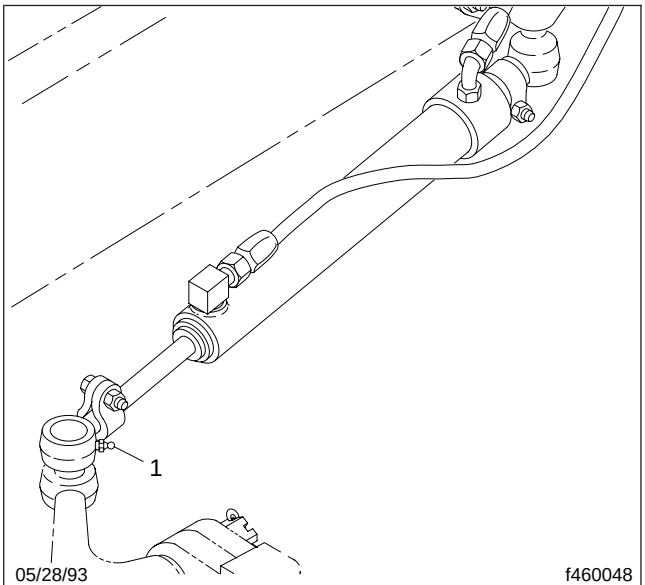
⚠ WARNING

Failure to keep the power steering reservoir full could result in damage to the power steering pump and improper operation of the power steering system.



1. Grease Fitting

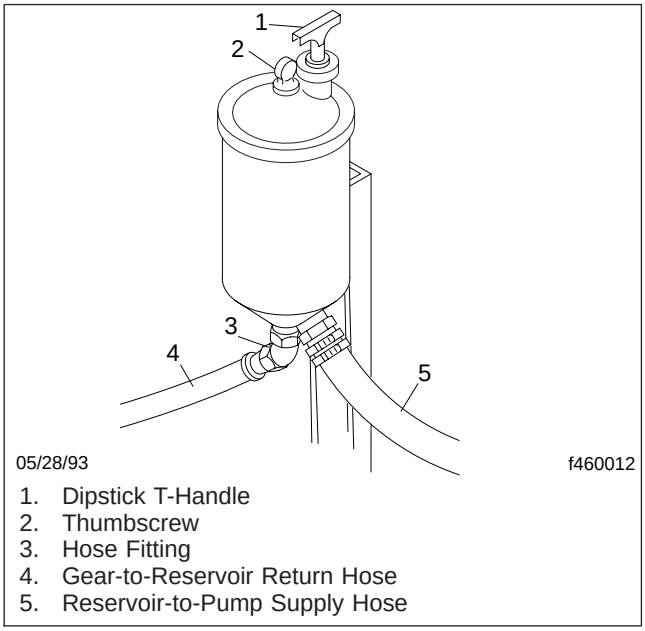
Fig. 6, Drag Link (axle steering arm end)



1. Grease Fitting (axle steering arm end)

Fig. 7, Power Steering Cylinder

1. Clean around the power steering reservoir dipstick (fill cap) with a clean rag. Then remove the dipstick (fill cap). See **Fig. 8**.



1. Dipstick T-Handle
2. Thumbscrew
3. Hose Fitting
4. Gear-to-Reservoir Return Hose
5. Reservoir-to-Pump Supply Hose

Fig. 8, 2-Quart Power Steering Reservoir, 2-Line (typical)

⚠ WARNING

Fill only with approved clean fluid. Failure to use the proper fluid could cause seal deterioration and leaks. Fluid leaks could eventually cause loss of power steering assist. This could lead to an accident resulting in personal injury or property damage. Wear eye protection when changing the fluid and filter.

2. With the power steering fluid at operating temperature, check the fluid level on the dipstick. If low, add enough fluid to bring the level up to the full mark on the dipstick. See **Table 1** for approved power steering fluid.
3. Install the dipstick (fill cap) in the power steering reservoir.

46–06 Power Steering Reservoir Fluid and Filter Changing

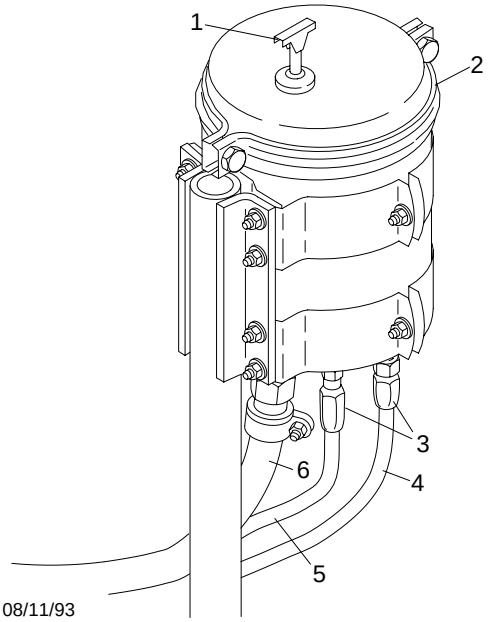
1. For a 2-quart or a 4-quart power steering reservoir, remove the dipstick, thumbscrew or cover capscrew, and cover. See **Fig. 8**.

Approved Power Steering Fluids	
Fluid Type	**Approved Fluid**
Automatic Transmission Fluid*	Dexron® II Dexron® III
Heavy-Duty Engine Oil* IMPORTANT: Do not use heavy-duty engine oil in vehicles built from November 4, 2002.	Union 10W–40 Texaco 10W–40 Chevron 10W–40 Union 15W–40 Shell Rotella T 30W

* Do not mix oil types. Refer to the text in this group for a detailed warning statement.

Table 1, Approved Power Steering Fluids

2. For a 9-quart power steering reservoir, remove the dipstick, band clamp, cover O-ring, and cover. See **Fig. 9**.

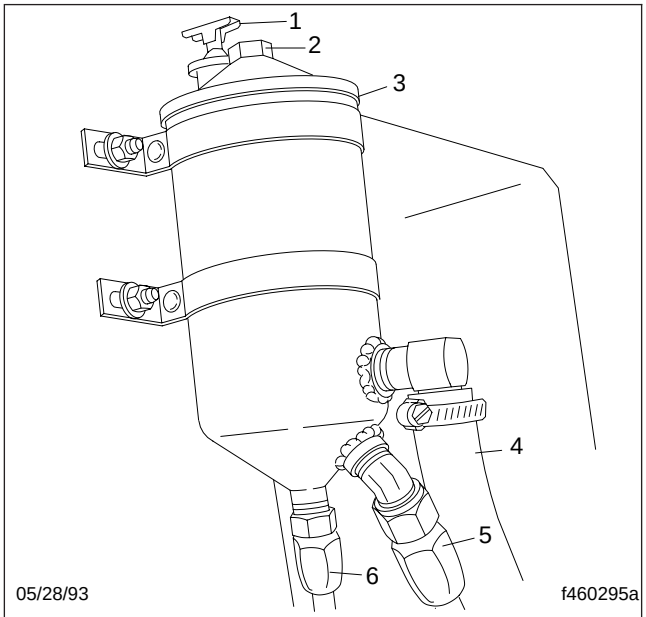


1. Dipstick T-Handle
2. Band Clamp
3. Hose Fittings
4. Pump-to-Reservoir Return (bypass) Hose
5. Gear-to-Reservoir Return Hose
6. Reservoir-to-Pump Supply Hose

Fig. 9, 9-Quart Power Steering Reservoir, 3-Line

3. For a 2-line system, drain the power steering reservoir by disconnecting the steering gear-to-reservoir return hose from the reservoir. Catch the fluid in a drain bucket. Cap the reservoir port.

   For a 3-line system, drain the power steering reservoir by disconnecting the steering gear-to-reservoir return hose from the reservoir, and catch the fluid in a drain bucket. Disconnect the power steering pump-to-reservoir return (bypass) hose from the reservoir fitting. Remove the fitting from the reservoir, and connect it to the bypass hose, then cap the bypass hose fitting and both reservoir ports. See **Fig. 9** or **Fig. 10**.



1. Dipstick T-Handle
2. Cover Capscrew
3. Reservoir Cover
4. Reservoir-to-Pump Supply Hose
5. Pump-to-Reservoir Return (bypass) Hose
6. Gear-to-Reservoir Return Hose

Fig. 10, 2-Quart Power Steering Reservoir, 3-Line

4. If equipped with a thumbscrew, remove the thumbscrew and spring that hold the filter element in the reservoir, and lift out the filter element. Otherwise, lift out the spring and filter element from the reservoir.
5. Thoroughly clean the reservoir with a lint-free cloth.
6. Install a new filter element in the reservoir and position the spring on top of the filter element. If so equipped, install and hand-tighten the thumbscrew to hold the spring and filter element in place.

WARNING

Fill only with approved clean fluid. Do not mix fluid types. Any mixture or any unapproved fluid could lead to seal deterioration and leaks. Fluid leakage could cause loss of power steering assist, possibly resulting in personal injury and property damage.

7. Fill the reservoir with approved power steering fluid. See **Table 1**.

IMPORTANT: Do not start the engine while draining the system.

8. Place the disconnected end of the steering gear-to-reservoir hose in a drain bucket. Raise the front of the vehicle with a floor jack and support it with jack stands. Have someone turn the steering wheel to full lock left and right, and capture the fluid flowing from the hose in the drain bucket. Add fluid to the reservoir as needed. Continue turning the steering wheel until clean power steering fluid flows from the hose into the drain bucket.
9. Remove the caps (as applicable) from the ports and fitting. For a 3-line system, remove the fitting from the pump-to-reservoir hose and attach it to the reservoir port. Connect the hose(s) to the reservoir. Tighten each hose fitting nut finger-tight, then tighten with a wrench until resistance is felt. Tighten one-sixth turn more. Do not over-tighten.

   Remove the jack stands and lower the vehicle.
10. Fill the reservoir with the same fluid used above, as needed. Start the engine and let it idle. Have someone turn the steering wheel to full stop in each direction until no bubbles are seen in the reservoir. Shut down the engine.
11. Install the cover and capscrew on the reservoir. Tighten the capscrew 10 to 15 lbf·ft (14 to 20 N·m). If equipped with a thumbscrew, install the cover and thumbscrew, and tighten the thumbscrew finger-tight. For a 9-quart reservoir, install a new O-ring, the band clamp, and the cover. Tighten the clamp bolts 40 lbf·ft (54 N·m).

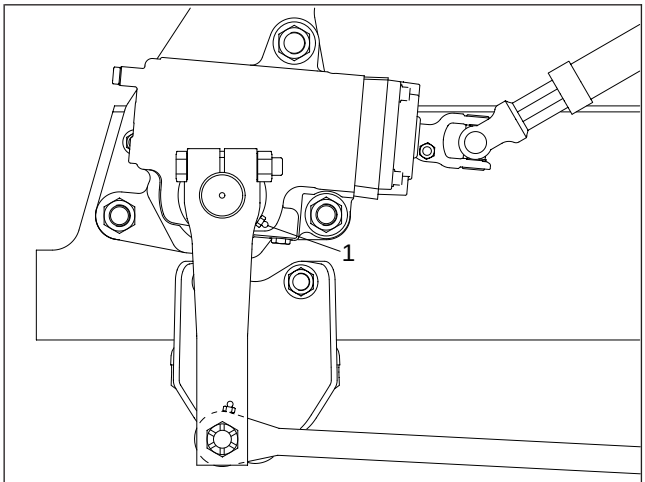
    Install the dipstick.
12. Start the engine. Check the reservoir for fluid leaks around the cover. If fluid leaks are present, shut down the engine and install a new reservoir cover gasket.
13. Check the power steering fluid level in the reservoir. If the fluid level is low, add more of the same fluid used above to bring the level up to the full mark on the dipstick.

46–07 Steering Driveline Deck Bearing Lubricating, FLA/FLB

For an FLA or an FLB, apply light oil sparingly to the deck bearing. Apply the oil at the deck bearing support cap (if equipped), or through the felt seal on top of the deck bearing support bracket.

46–08 TRW Power Steering Gear Lubricating, TAS Series

1. Wipe off debris from the grease fitting. See **Fig. 11**.



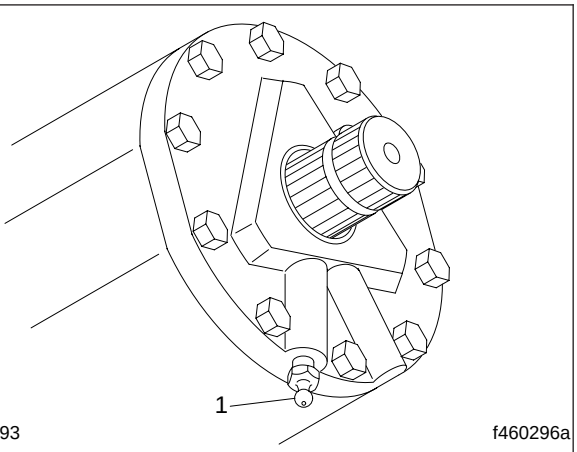
1. Sector Shaft Grease Fitting

Fig. 11, TRW TAS Series Sector Shaft Lubricating

2. Using a hand-type grease gun, apply multipurpose chassis grease until grease starts coming out of the sector shaft dirt and water seal.

46–09 Sheppard Power Steering Gear Bearing Cap Lubricating

Wipe the bearing cap grease fitting clean. See **Fig. 12**. Using a pressure gun, apply multipurpose chassis grease to the bearing cap until old grease is forced out.



1. Grease Fitting

Fig. 12, Sheppard Power Steering Gear Bearing Cap

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Fuel Separator Sight Bowl Cleaning and Element Replacing	47–03
Fuel Tank Band Nut Tightening, FLA, FLB, and FLD	47–02
Fuel Tank Vent Checking	47–01

47–01 Fuel Tank Vent Checking

On earlier vehicles with a screw-on fuel cap, remove the fuel cap and clean it with solvent. Make sure the fuel cap vent is open. Install the cap.

On vehicles with a quarter-turn fuel cap, check to be sure the vent line at the inboard side of the fuel tank is clean and not plugged.

47–02 Fuel Tank Band Nut Tightening, FLA, FLB, and FLD

Hold each fuel tank band retention nut with a wrench while backing off its jam nut. Then tighten the retention nuts 30 to 45 lbf·ft (41 to 60 N·m). After the retention nuts have been tightened, hold each with a wrench while tightening its jam nut 50 to 65 lbf·ft (68 to 88 N·m). Do not overtighten.

47–03 Fuel Separator Sight Bowl Cleaning and Element Replacing

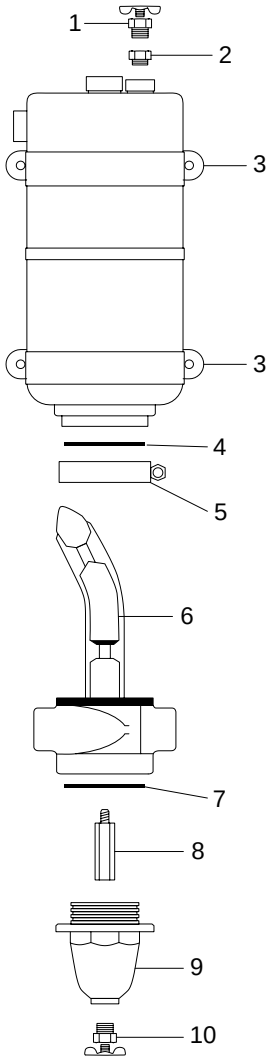
ConMet Fuel Separator Sight Bowl Cleaning

The only maintenance necessary on ConMet fuel separators is to clean the sight bowl, if equipped. See **Fig. 1**.

⚠ WARNING

Diesel fuel is flammable and can ignite if exposed to an open flame, intense heat, or other ignition source. Do not drain fuel near, or expose fuel vapor to open flame or intense heat. Exposure to open flame or intense heat could start a fire, possibly resulting in personal injury or property damage. When working on a fuel system, have a fire extinguisher within easy reach.

1. Drain the fuel separator.
2. Unscrew the sight bowl from the fuel separator.
3. Wipe the sight bowl clean using a soft cloth.



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1. Vacuum Breaker/Drain Valve
2. Reducer Bushing
3. Mounting Brackets
4. O-Ring (when equipped with heater)
5. Stainless Steel V-Clamp (when equipped with heater)
6. Heater Assembly
7. Gasket
8. Sight Bowl Heater Rod
9. Sight Bowl Assembly
10. Vacuum Breaker/Drain Valve

Fig. 1, ConMet Fuel Separator

4. Lubricate the gasket with a film of oil, and reinstall it on the sight bowl. If the gasket appears dry-rotted or damaged, replace the gasket.

5. Lightly lubricate the threads on the sight bowl with oil, then thread the sight bowl into the bottom of the fuel separator.
6. Hand-tighten until the gasket is in full contact with the fuel separator, then tighten an additional 1/4 to 1/3 turn.
7. Check that the drain valve is tightened and closed.
8. Prime the fuel separator.
   - 8.1 Remove the vacuum breaker fitting and fill the unit with diesel fuel.
   - 8.2 Install and close the vacuum breaker fitting when the unit is full of fuel.

   IMPORTANT: The fitting must be air-tight and the valve closed.

Racor Fuel Separator Element Replacement

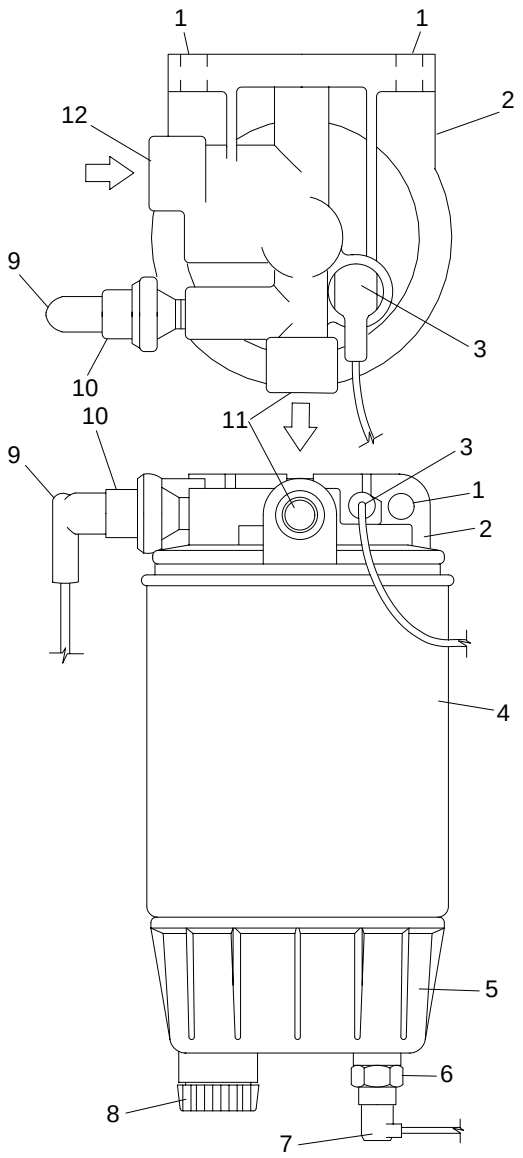
The only service necessary on Racor fuel separators is to replace the filter element. See **Fig. 2**.

Racor 325R and 330R

⚠ WARNING

Diesel fuel is flammable and can ignite if exposed to an open flame, intense heat, or other ignition source. Do not drain fuel near, or expose fuel vapor to open flame or intense heat. Exposure to open flame or intense heat could start a fire, possibly resulting in personal injury or property damage. When working on a fuel system, have a fire extinguisher within easy reach.

1. Disconnect the water sensor probe connector, if equipped.
2. Place a suitable container under the fuel heater/water separator, then drain the fuel from the fuel heater/water separator by opening the drain valve.
3. Remove the filter element and collection bowl together, by turning the filter element off of the mounting head.
4. Remove the filter element from the collection bowl by turning the collection bowl; then discard the filter element.



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1. Mounting Hole
2. Mounting Head
3. Heater Connector
4. Filter Element
5. Collection Bowl
6. Water Sensor
7. Water Sensor Connector
8. Drain Valve
9. Vacuum Switch Connector
10. Vacuum Switch
11. Fuel Outlet
12. Fuel Inlet

Fig. 2, Racor 325R Fuel Heater/Water Separator (330R similar)

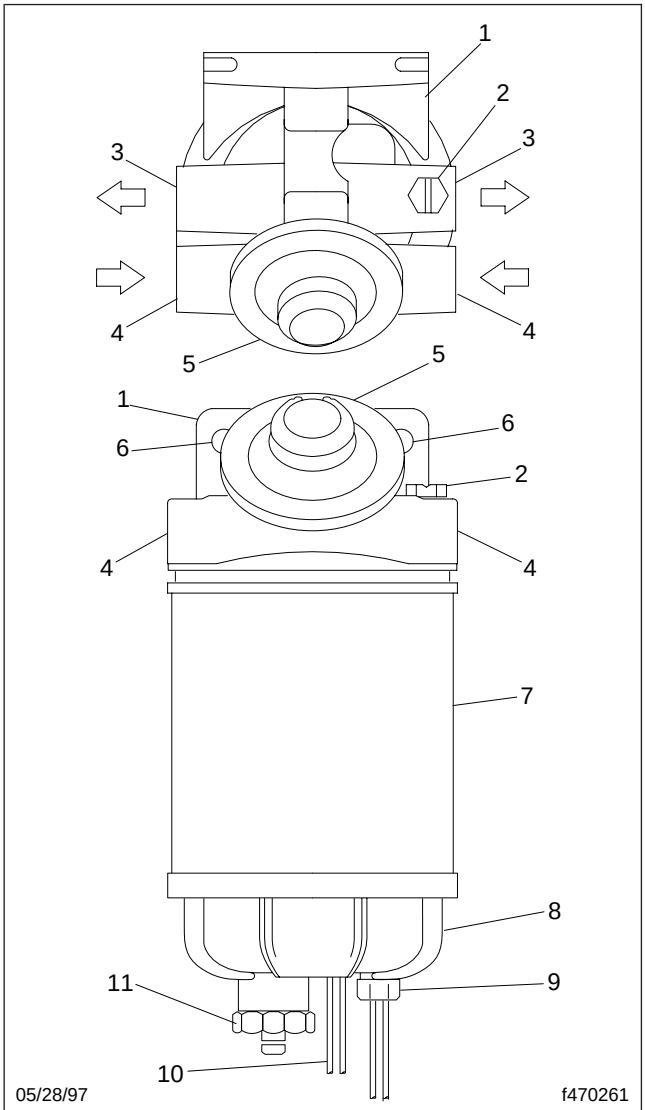
5. Remove and discard the bowl O-ring; then clean the bowl of debris using diesel fuel only. Clean the bowl O-ring seat with a shop cloth.
6. Lubricate the new bowl O-ring with clean diesel fuel or motor oil; then seat it into the collection bowl.
7. Attach the collection bowl to a new filter element, hand-tight. Do not use tools.
8. Lubricate the new filter element square-cut gasket with clean diesel fuel or motor oil.
9. Fill the filter and bowl assembly with clean diesel fuel.
10. Spin the filter and bowl assembly onto the mounting head until the gasket contacts the head base; then turn it an additional 1/3 to 3/4 of a turn.
11. Connect the water sensor probe connector if equipped.
12. Start the engine and check for fuel leaks. Repair all fuel leaks with the engine OFF.

Racor 460R

⚠ WARNING

Diesel fuel is flammable and can ignite if exposed to an open flame, intense heat, or other ignition source. Do not drain fuel near, or expose fuel vapor to open flame or intense heat. Exposure to open flame or intense heat could start a fire, possibly resulting in personal injury or property damage. When working on a fuel system, have a fire extinguisher within easy reach.

1. Disconnect the water sensor probe connector, if equipped. See **Fig. 3**.
2. Disconnect the bowl heater connector, if equipped.
3. Place a suitable container under the fuel heater/water separator, then loosen the vent plug and drain the fuel from the fuel heater/water separator by opening the drain valve.
4. Remove the filter element and collection bowl together, by turning the filter element off of the mounting head.
5. Remove the filter element from the collection bowl by turning the collection bowl; then discard the filter element.



1. Mounting Head
2. Vent Plug
3. Fuel Outlet
4. Fuel Inlet
5. Fuel Priming Pump
6. Mounting Hole
7. Filter Element
8. Collection Bowl
9. Water Sensor Probe
10. Fuel Heater Wire
11. Drain Valve

Fig. 3, Racor 460R Fuel Heater/Water Separator

6. Remove and discard the bowl O-ring; then clean the bowl of debris using diesel fuel only. Clean the bowl O-ring seat with a shop cloth.
7. Lubricate the new bowl O-ring with clean diesel fuel or motor oil; then seat it into the contaminant bowl.

8. Attach the collection bowl to a new filter element, hand-tight. Do not use tools.
9. Lubricate the new filter element square-cut gasket with clean diesel fuel or motor oil.
10. Spin the filter and bowl assembly onto the mounting head until the gasket contacts the head base; then turn it an additional 1/3 to 3/4 of a turn.
11. Connect the water sensor probe connector if equipped.
12. Connect the bowl heater connector if equipped.
13. Loosen the vent plug, then operate the primer pump until the fuel purges at the vent plug. Then close the vent plug.
14. Start the engine and check for fuel leaks. Repair all fuel leaks with the engine OFF.

Racor 490R

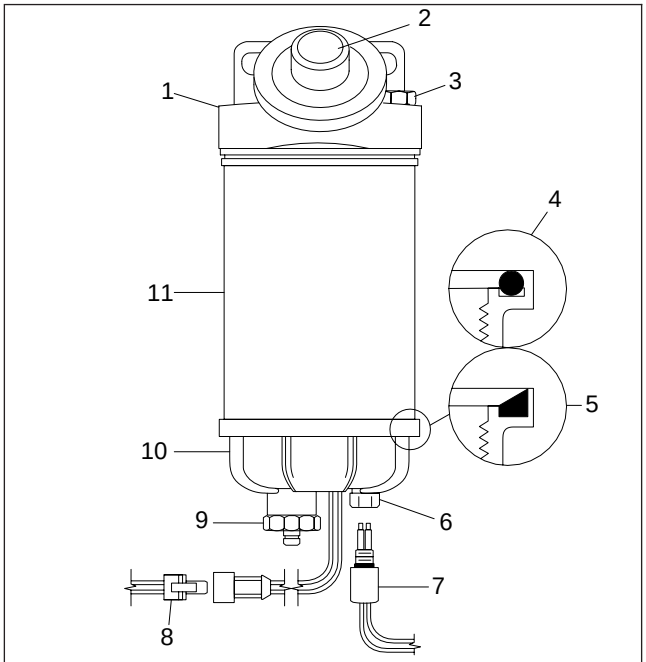
⚠ WARNING

Diesel fuel is flammable and can ignite if exposed to an open flame, intense heat, or other ignition source. Do not drain fuel near, or expose fuel vapor to open flame or intense heat. Exposure to open flame or intense heat could start a fire, possibly resulting in personal injury or property damage. When working on a fuel system, have a fire extinguisher within easy reach.

1. Drain off some fuel by loosening the vent plug and opening the drain valve. See **Fig. 4**.
2. Disconnect the water sensor and heater connections, if equipped.
3. Remove the element and bowl, together, by turning counterclockwise.
4. Remove the bowl from the element, and clean the O-ring.
5. Apply a coating of clean fuel or motor oil to the new O-ring and element seal.
6. Spin the bowl onto the new element, then spin them both onto the filter head snugly, by hand only.

IMPORTANT: Do not use tools to tighten.

7. Connect the water sensor and heater connectors, if equipped.



1. Mounting Head
2. Fuel Primer Pump
3. Metal Vent Plug
4. Bowl O-Ring
5. Bowl Bevel-Cut Gasket
6. Bowl Probe Plug
7. Water Sensor Probe
8. Heater Connector
9. Bowl Drain Valve Assembly
10. Bowl with Drain and Water Sensor
11. Service Element

Fig. 4, Racor 490R Fuel Separator

8. Prime the fuel separator.
   - 8.1 Loosen the vent plug. Then operate the primer pump until the fuel purges at the vent plug.
   - 8.2 Close the vent plug.
9. Start the engine and check for fuel leaks.
10. Shut down the engine and correct any fuel leaks.

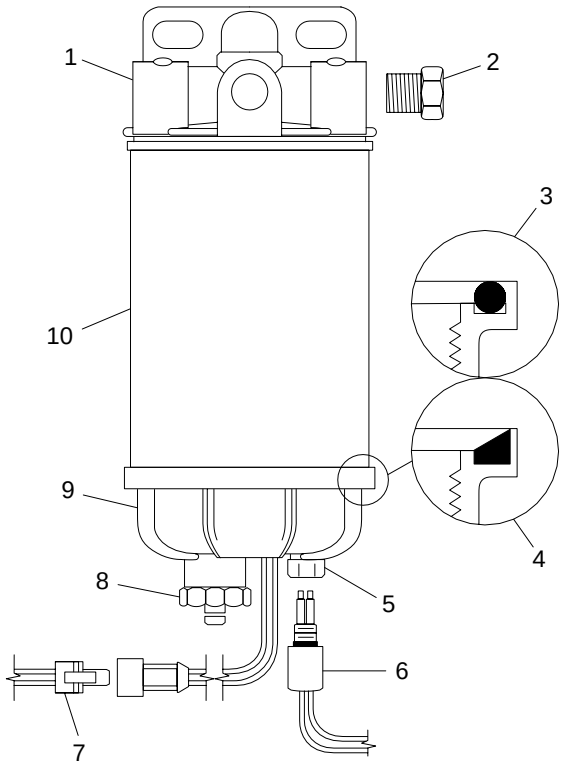
Racor 690R and 6120R

⚠ WARNING

Diesel fuel is flammable and can ignite if exposed to an open flame, intense heat, or other ignition source. Do not drain fuel near, or expose fuel vapor to open flame or intense heat. Exposure to open flame or intense heat could start a fire, possibly resulting in personal injury or property dam-

age. When working on a fuel system, have a fire extinguisher within easy reach.

1. Drain off some fuel by loosening the vent plug and opening the drain valve. See **Fig. 5**.



1. Mounting Head
2. Metal Plug, 3/8" NPT
3. Bowl O-Ring
4. Bowl Bevel-Cut Gasket
5. Bowl Probe Plug
6. Water Sensor Probe
7. Heater Connector
8. Bowl Drain Valve Assembly
9. Bowl with Drain and Water Sensor
10. Service Element

Fig. 5, Racor 690R Fuel/Water Separator (6120R Similar)

2. Disconnect the water sensor and heater connections, if equipped.
3. Remove the element and bowl, together, by turning counterclockwise.
4. Remove the bowl from the element, and clean the O-ring.
5. Apply a coating of clean fuel or motor oil to the new O-ring and element seal.
6. Spin the bowl onto the new element, then spin them both onto the filter head snugly, by hand only.

IMPORTANT: Do not use tools to tighten.

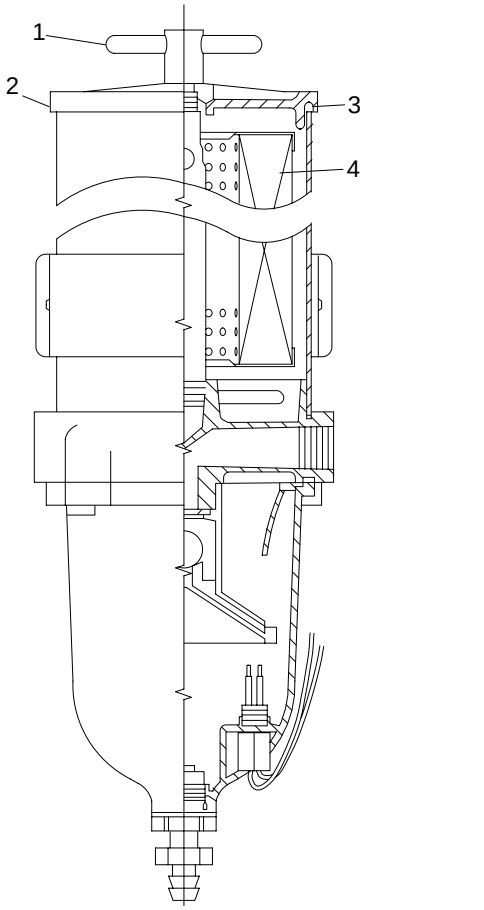
7. Connect the water sensor and heater connectors, if equipped.
8. Prime the fuel separator.
   - 8.1 Remove the 3/8-inch metal plug located at the top of the fuel/water separator (see **Fig. 5**, Ref. 2), and manually fill the unit with diesel fuel.
   - 8.2 Install and tighten the 3/8-inch metal plug when the unit is full.
9. Start the engine and check for fuel leaks.
10. Shut down the engine and correct any fuel leaks.

Racor 900FG and 1000FG

⚠ WARNING

Diesel fuel is flammable and can ignite if exposed to an open flame, intense heat, or other ignition source. Do not drain fuel near, or expose fuel vapor to open flame or intense heat. Exposure to open flame or intense heat could start a fire, possibly resulting in personal injury or property damage. When working on a fuel system, have a fire extinguisher within easy reach.

1. Remove the lid by turning the T-handle. See **Fig. 6**.
2. Remove the filter element by raising the handle built into the filter element; then carefully turn the filter element while lifting up.
3. Remove and discard the lid gasket; then replace it with and new one.
4. Lubricate the lid gasket with clean diesel fuel; then seat it into the lid.
5. Fill the unit with clean diesel fuel.
6. Install the lid; then tighten it hand-tight, or to 10 lbf·ft (14 N·m).
7. Start the engine and check for fuel leaks. Repair all fuel leaks with the engine OFF.



1. T-Handle
2. Lid
3. Lid Gasket
4. Filter Element

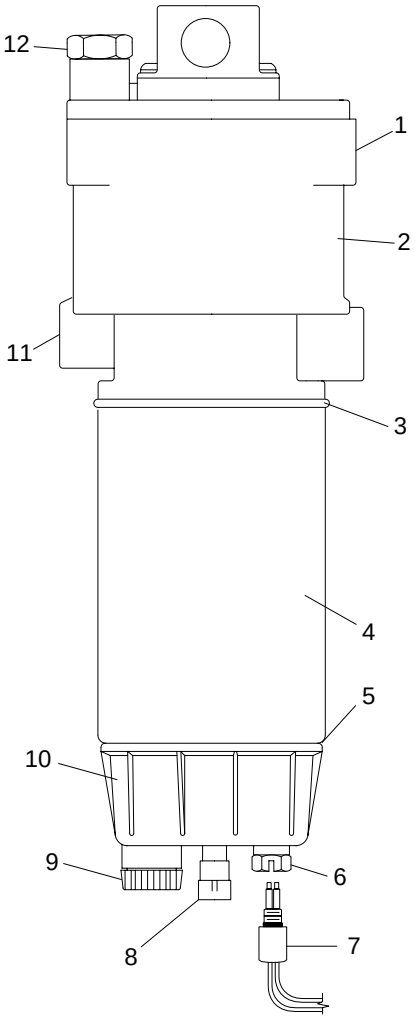
Fig. 6, Racor 900FG Fuel Heater/Water Separator (1000FG similar)

Racor 6400

⚠ WARNING

Diesel fuel is flammable and can ignite if exposed to an open flame, intense heat, or other ignition source. Do not drain fuel near, or expose fuel vapor to open flame or intense heat. Exposure to open flame or intense heat could start a fire, possibly resulting in personal injury or property damage. When working on a fuel system, have a fire extinguisher within easy reach.

1. Disconnect the water sensor probe connector and bowl heater connector, if equipped. See **Fig. 7**.



1. Fuel Inlet
2. Head Assembly
3. Filter Top Seal
4. Filter Element
5. Bowl O-Ring Seal
6. Water Sensor Probe Plug
7. Water Sensor Probe
8. Bowl Heater Connector
9. Drain Valve
10. Contaminant Collection Bowl
11. Fuel Outlet
12. Priming Plug

Fig. 7, Racor 6400 Fuel Heater/Water Separator

2. Place a suitable container under the fuel heater/water separator, then drain the fuel from

the fuel heater/water separator by opening the drain valve.

3. Remove the filter element and collection bowl together, by turning the filter element off of the mounting head.
4. Remove the filter element from the collection bowl by turning the collection bowl; then discard the filter element.
5. Remove and discard the bowl O-ring; then clean the bowl of debris using diesel fuel only. Clean the bowl O-ring seat with a shop cloth.
6. Lubricate the new bowl O-ring with clean diesel fuel or motor oil; then seat it into the collection bowl.
7. Attach the collection bowl to a new filter element, hand-tight. Do not use tools.
8. Lubricate the new filter element gasket with clean diesel fuel or motor oil.
9. Spin the filter and bowl assembly onto the mounting head until the gasket contacts the head base; then turn it an additional 1/3 to 3/4 of a turn.
10. Connect the water sensor probe connector and bowl heater connector, if equipped.
11. Remove the priming plug located at the top of the fuel/water separator and manually fill the fuel/water separator with clean diesel fuel. Install and tighten the priming plug
12. Start the engine and check for fuel and coolant leaks. Repair all leaks with the engine OFF.

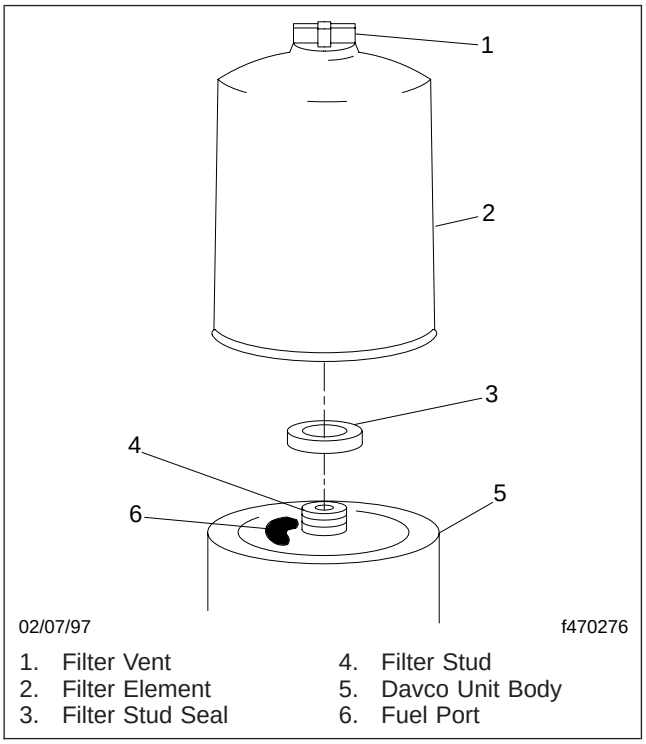
Davco Fuel Heater/Water Separator Filter Element Replacement

Davco 321

The only maintenance necessary on Davco 321 fuel separators is to replace the filter element. See **Fig. 8**.

⚠ WARNING

Diesel fuel is flammable and can ignite if exposed to an open flame, intense heat, or other ignition source. Do not drain fuel near, or expose fuel vapor to open flame or intense heat. Exposure to open flame or intense heat could start a fire, possibly resulting in personal injury or property damage. When working on a fuel system, have a fire extinguisher within easy reach.



1. Filter Vent
2. Filter Element
3. Filter Stud Seal
4. Filter Stud
5. Davco Unit Body
6. Fuel Port

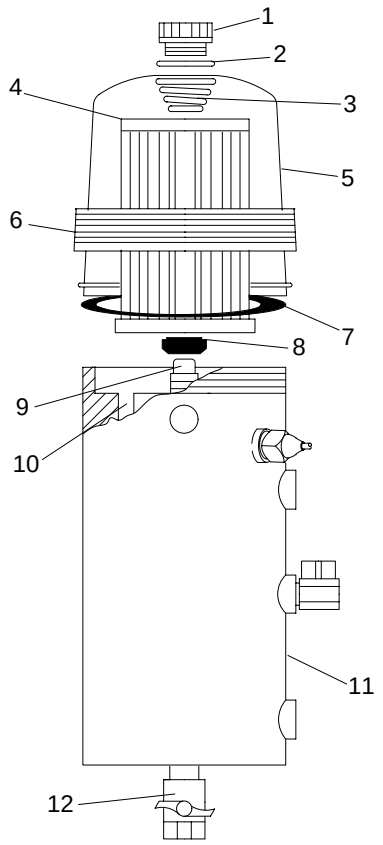
Fig. 8, Davco 321

1. Place a suitable container under the fuel heater/water separator. Open the filter vent using a 1-1/8 wrench; then drain the fuel from the fuel heater/water separator by opening the drain valve.
2. Close the drain valve.
3. Remove the filter element by spinning the filter element off of the fuel heater/water separator body.
4. Remove the filter stud seal; then clean the top of the unit body.
5. Add fuel to the fuel heater/water separator housing until it reaches the top of the fuel port.
6. Install a new filter stud seal.
7. Coat the filter gasket with clean oil. Spin the filter element onto the unit housing unit it contacts the gasket; then turn it 1/2 to 3/4 turns more. Do not use a filter wrench to tighten the filter

8. Start the engine, then raise the rpm for 1 to 2 minutes to purge air from the system and check for fuel leaks.
9. Shut down the engine and correct any fuel leaks.

Davco 380

The only maintenance necessary on Davco 380 fuel separators is to replace the filter element. See **Fig. 9**.



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1. Filter Vent
2. Filter Vent Seal
3. Filter Spring
4. Filter Element
5. Filter Cover
6. Filter Collar
7. Filter Cover Seal
8. Grommet
9. Threaded Filter Stud (for emergency use)
10. Fuel Port
11. Davco Unit Body
12. Drain Valve

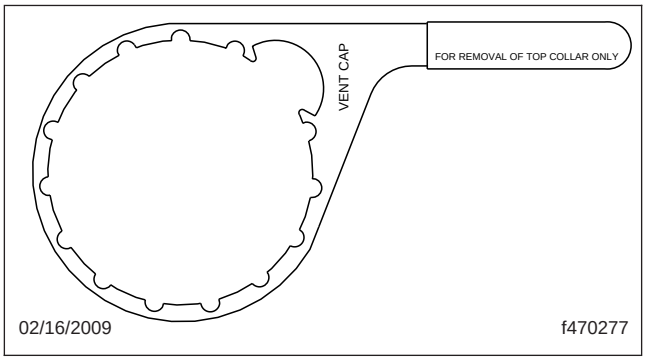
Fig. 9, Davco 380

WARNING

Diesel fuel is flammable and can ignite if exposed to an open flame, intense heat, or other ignition source. Do not drain fuel near, or expose fuel vapor to open flame or intense heat. Exposure to open flame or intense heat could start a fire, possibly resulting in personal injury or property damage. When working on a fuel system, have a fire extinguisher within easy reach.

Note: As an emergency option, the Davco 380 will accept a spin-on type filter onto its threaded filter stud with the grommet removed.

1. Place a suitable container under the fuel heater/water separator. Open the filter vent. Drain the fuel below the collar level by opening the drain valve; then close the drain valve.
2. Remove the filter collar using the Davco filter collar wrench. See **Fig. 10.**



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Fig. 10, Davco Filter Collar Wrench (Davco P/N 380134)

3. Remove the filter cover. Retain the filter cover seal for re-use.
4. Remove the filter element; remove the grommet from the element; then discard the element. Retain the grommet for re-use.
5. Add fuel to the fuel heater/water separator housing until it reaches the top of the fuel port.
6. Install the grommet on the new filter element.

CAUTION

Do not use the filter collar wrench to tighten the filter collar. Using the filter wrench to tighten the collar can damage the collar, resulting in a fuel leak.

7. Install the filter element, filter cover and cover seal, and filter collar. Hand-tighten the filter collar.
8. Remove the filter vent; then fill with fuel until fuel is about 1 inch above the collar. Install the filter vent.
9. Start the engine, then raise the rpm for 1 minute to purge air from the system and check for fuel leaks.
10. Shut down the engine and correct any fuel leaks.

Index, Alphabetical

Title of Maintenance Operation (MOP) **MOP Number**

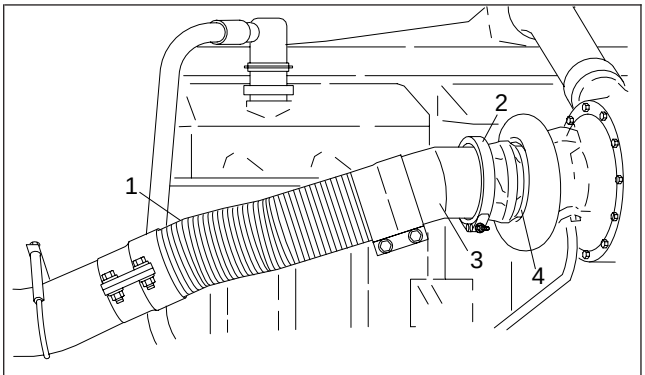
Exhaust System Inspecting (Noise Emission Control). 49–01

49–01 Exhaust System Inspecting (Noise Emission Control)

Pre-EPA07 Exhaust System Inspecting

In addition to inspecting the exhaust system at the scheduled maintenance interval, inspect the exhaust system if the noise level of the vehicle has increased. Replace parts that show leakage, wear, or damage, with genuine Freightliner parts.

1. On all vehicles, check the condition of the muffler body, top stack, or top stack silencer. Check the inlet/outlet tubes for leakage, dents, and corrosion, and check for holes in the muffler. Replace parts as required. Use new parts, equivalent to parts originally installed on the vehicle. See **Group 49** of the *Heavy-Duty Trucks Service Manual* for replacement procedures.
2. Inspect the exhaust flex hose (see **Fig. 1**) for leakage, wear, or damage. Replace with new parts if replacement is needed.
3. Check for leakage at the V-band coupling that attaches the exhaust pipe to the turbocharger exhaust outlet. See **Fig. 1**.



1. Flex Hose
2. V-Band Coupling
3. Exhaust Pipe
4. Turbocharger Exhaust Outlet

Fig. 1, V-Band Coupling and Flex Hose

4. If leakage exists, tighten the nut on the V-band coupling 85 lbf·in (940 N·cm). If leakage persists, install a new V-band coupling.
5. Inspect the turbo outlet pipe, and replace it as needed.
6. Check the U-bolt clamps for tightness, and tighten as needed.
7. Check for leakage at all wide-band exhaust clamps. See **Fig. 2**, **Fig. 3**, or **Fig. 4**.

   If leakage exists, tighten the nuts 40 to 60 lbf·ft (54 to 81 N·m). If leakage persists, install a new wide-band exhaust clamp. Do not re-use Donaldson Seal Clamps.

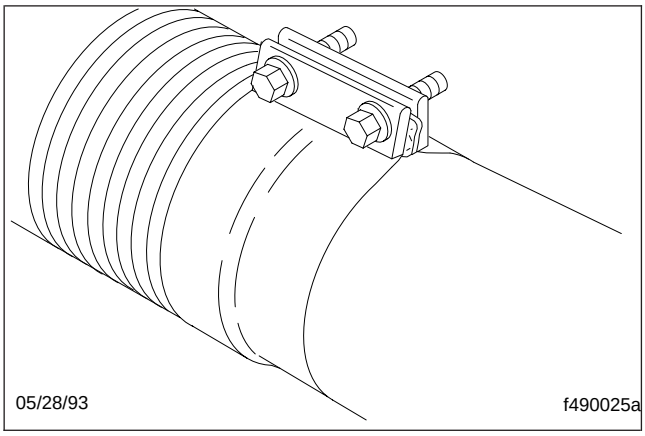


Fig. 2, Donaldson Seal Clamp Wide-Band Exhaust Clamp

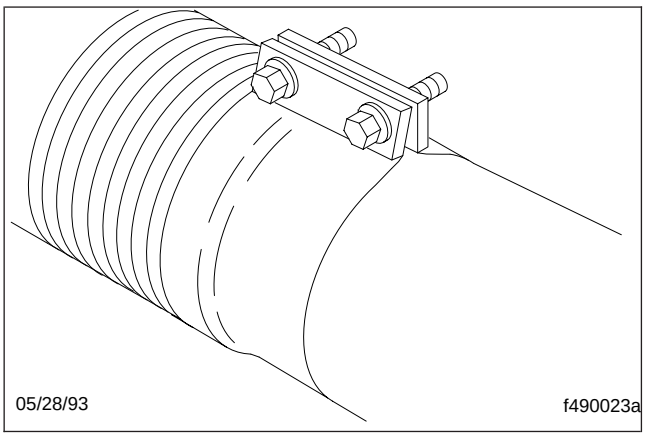


Fig. 3, Riker Tru-Seal Wide-Band Exhaust Clamp

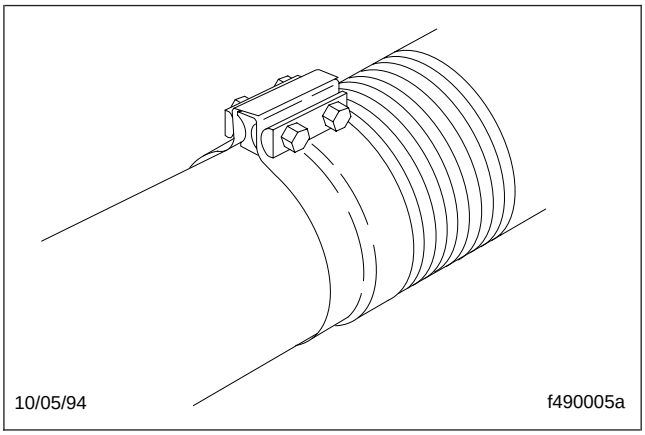


Fig. 4, Torca Torctite Wide-Band Exhaust Clamp

EPA07 Exhaust System Inspecting

IMPORTANT: The Environmental Protection Agency's 2007 regulations require lower exhaust emissions, thus requiring new exhaust system components. See **Fig. 5**. In particular the after-treatment device (ATD), which is part of the after-treatment system (ATS), requires special attention during regularly scheduled maintenance inspections. If any discrepancies are discovered, refer to the engine manufacturer's service literature for repair instructions.

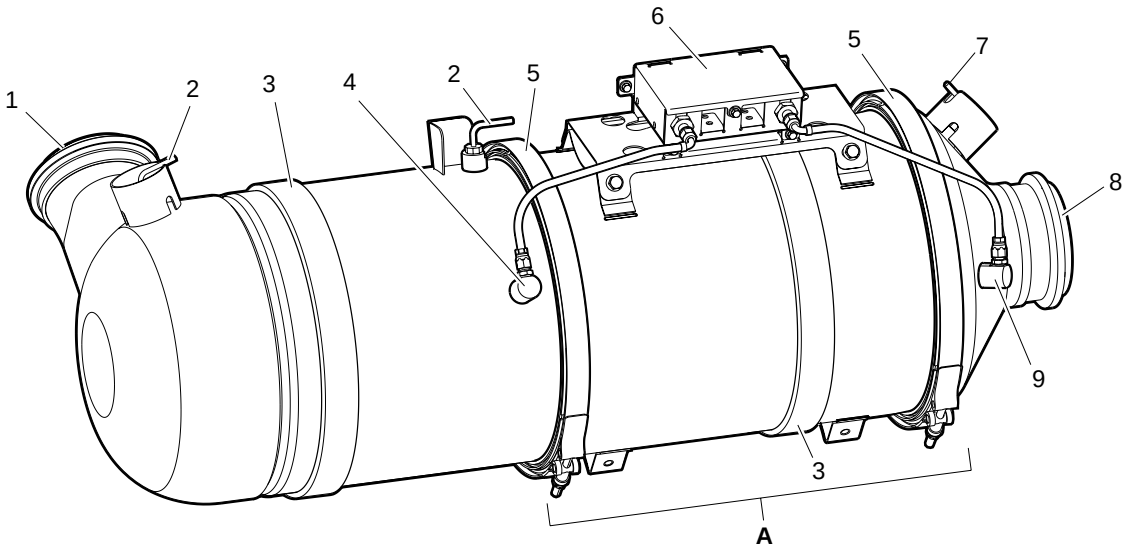
Definitions of ATS Components

Refer to the following list of definitions of ATS components.

- After-Treatment System (ATS)—the entire exhaust system from the turbocharger to the exhaust stack or tail pipe.
- After-Treatment Device (ATD)—a muffler-like canister that houses a DPF, DOC, and sensors.
- Diesel Particulate Filter (DPF)—a filter that collects and holds particulate matter (soot and ash).
- Diesel Oxidation Catalyst (DOC)—oxidizes hydrocarbons and reduces NOx.
- Sensors—detect temperatures and pressures in the ATS.

Inspection

1. Check for leakage at the clamp that attaches the exhaust pipe to the turbocharger exhaust outlet. If leakage exists, tighten the nut on the clamp to the required torque. If leakage persists, install a new clamp.
2. Check the exhaust pipe, bellows, and each exhaust seal clamp for leakage, wear, cracks, or damage. Replace damaged components as needed. If leakage exists at a clamp, tighten the nuts to the required torque. If leakage persists, install a new exhaust seal clamp. Do not reuse seal clamps. Once a seal clamp is loosened or removed, it must be replaced.
3. If present, check the condition of the insulation material around the exhaust pipe between the turbocharger and the ATD.
4. Check the ATD mounting bands for tightness. Tighten to 30 lbf·ft (41 N·m) if needed. Do not overtighten.
5. Check for leaks around the clamps that attach the ATD in the ATS, and around the clamps that retain the DPF in the ATD. No leaks are allowed anywhere in the system.
6. Check all sensors attached to the ATD for leaks or damaged wires. No leaks are allowed.
7. Check the DPF exterior surface for dents or other damage. See Item A of **Fig. 5**. A dent over 3 inches (76 mm) in diameter and 1/4-inch (6-mm) deep could cause internal damage to the DPF, causing it to malfunction.
8. Check for heat discoloration on the surface of the ATD. Heat discoloration may indicate internal damage; especially around the DPF.
9. Check any wires, lines, or hoses within 4 inches (10 cm) of the exhaust system for heat damage. Repair or reroute as needed.



A. Inspect this area of the canister for dents.
1. Marmon Fitting at Inlet from Turbocharger
2. DOC Temperature Sensor
3. ATD Mounting Band
4. DPF Intake Pressure Sensor
5. DPF V-Band Mounting Clamps
6. Sensor Housing
7. DPF Outlet Temperature Sensor
8. Exhaust Outlet Marmon Fitting
9. DPF Outlet Pressure Sensor

Fig. 5, Typical After-Treatment Device

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Electrical System Checking	54–01
Speedometer/Tachometer Cable Lubricating	54–02

54–01 Electrical System Checking

NOTE: Tighten electrical system connections to the torque values in **Table 1**.

Torque Values for Electrical System Connections	
Connection	**Torque: lbf·in (N·cm)**
Electrical Panel Stopnut	30 (340)
Air/Oil Junction Block Ring-Terminal Nut	30 (340)
Battery Terminal	70 (800)
Main Cab-Power Stud Hexnut	175 (1980)
Main Cab-Ground Stud Hexnut	50 (560)

Table 1, Torque Values for Electrical System Connections

Cab Interior

Inspect the wiring and electrical connections at the electrical mounting plate, cab-to-chassis interface connectors, cab-to-engine interface connectors, main cab-power and cab-ground studs, and electrical junction blocks.

- For an FLA, see **Fig. 1** and **Fig. 2**.
- For an FLB, see **Fig. 3** and **Fig. 4**.
- For an FLC (LH DR), see **Fig. 5** and **Fig. 6**.
- For an FLD, see **Fig. 7**.
- For an FLC (RH DR), see **Fig. 8** and **Fig. 9**.

For an FLA, uncover the electrical mounting plate by removing the tunnel top cover. The cover is held in place by Velcro®. Pull upward on the left front and rear corners, then tip the cover up and to the right. Uncover the electrical junction block by removing the tunnel right-hand kick panel.

For an FLB, uncover the electrical mounting plate by removing the tunnel left-hand cover. See **Fig. 10**, Ref. 3. Loosen the quarter-turn fastener (Ref. 2) at the lower rear edge of the cover, then pull back on the cover to unfasten the Velcro.

Remove the tunnel right-hand cover (Ref. 7) by moving the passenger seat up and back, removing the screw (Ref. 4) at the upper left edge, and removing the two screws (Ref. 6) at the lower right edge. Pull the cover right and back, to clear the combo cover and manifest box (Refs. 8 and 10). Then pull the cover upward between the seat and tunnel.

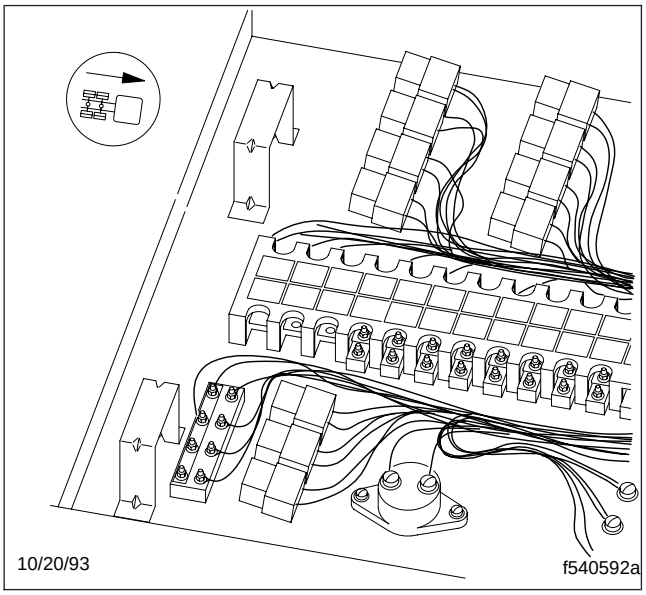


Fig. 1, FLA Electrical Mounting Plate

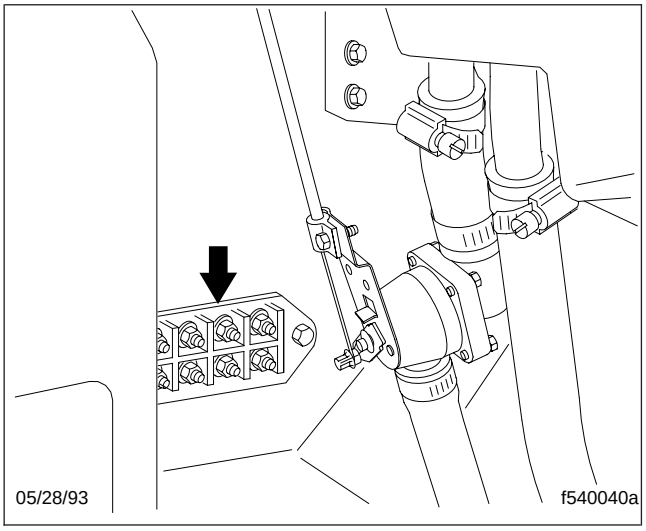
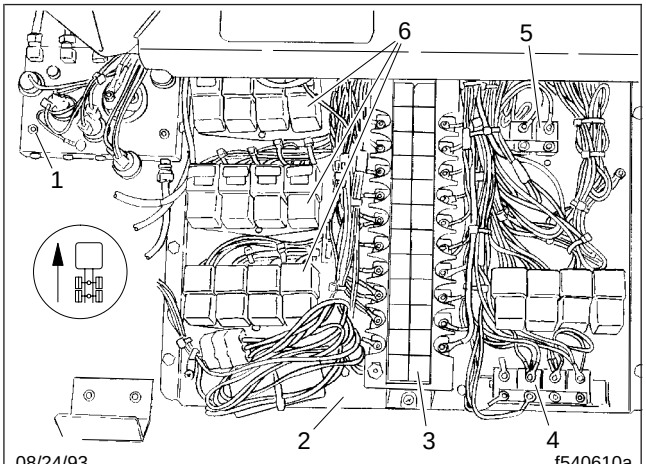


Fig. 2, FLA Electrical Junction Block

For an FLC (LH DR), uncover the main cab connectors and studs by removing the right-hand underdash cover. See **Fig. 11**, Ref. 1. Uncover the electrical mounting plate by opening the glove box (Ref. 2), then moving the stops at the upper edge of the box toward each other, while swinging the glove box down and out of the dash.



1. Air/Oil Junction Block
2. Electrical Mounting Plate
3. Circuit Breaker Bus Bar
4. Four-Position Junction Block
5. Two-Position Junction Block
6. Relays

Fig. 3, FLB Electrical Mounting Plate

For an FLD, uncover the electrical mounting plate by removing the access panel from the dash skirt under the center section of the dash. The panel is attached to the skirt by three quarter-turn fasteners.

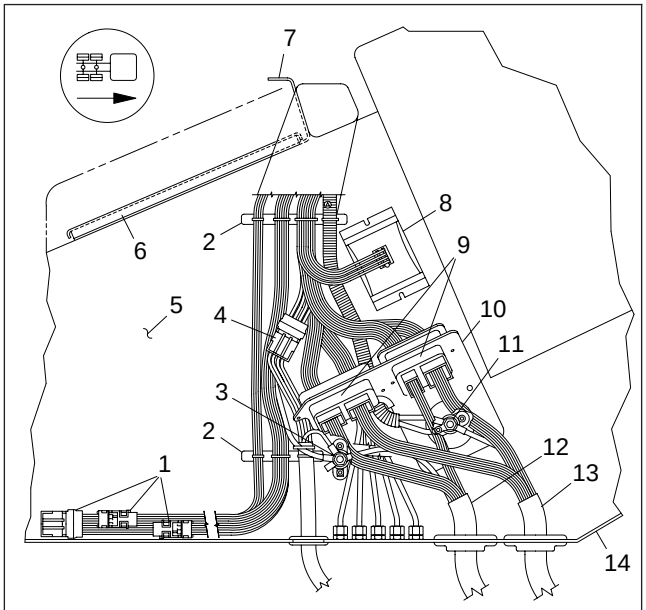
For an FLC (RH DR), uncover the main cab connectors and studs by removing the left-hand under-dash cover. See **Fig. 9**. Uncover the electrical panel by removing the glove box on the left side of the dash. To remove the glove box, open the glove box door and remove the six screws from the glove box liner. See **Fig. 12**. Then, remove the glove box door and the glove box liner from the dash. This will expose the electrical panel. See **Fig. 8**.

Check all wiring for chafing, kinks, and discolored insulation. Find the cause of any problems, then repair, replace, or reroute wires as needed.

Check that all relays are firmly seated in their mounting plates.

Check the tightness of the connections on the electrical junction block(s), main cab-power stud, and cab-ground stud, as equipped. Tighten the fasteners to the torque values in **Table 1**.

Install all of the removed panels.



1. Bunk Harness Connectors
2. Cable Tie Plate
3. Main Cab-Ground Stud (Black)
4. Seven-Way Receptacle Harness Connector
5. Right-Hand Tunnel Side
6. Electrical Mounting Plate (end view)
7. Dash Support Bracket (end view)
8. Daytime Running Lights Module
9. Cab-to-Chassis and Cab-to-Engine Harness Interface Connectors
10. Bulkhead Support Bracket
11. Main Cab-Power Stud (Red)
12. Main Cab Harness
13. Main Engine Harness
14. Right-Hand Cab Deck

Fig. 4, FLB Main Cab Harness Connectors

Cab Exterior

For an FLC, check the 40-way connector on the firewall (left side for a RH DR vehicle and right side for a LH DR vehicle), and check the power and ground studs. Check the terminals for tightness, damage, corrosion, and dirt. See **Fig. 13** (LH DR) or **Fig. 14** (RH DR).

Chassis

1. Check the main chassis wiring harness. Check the wiring insulation for damage from chafing or

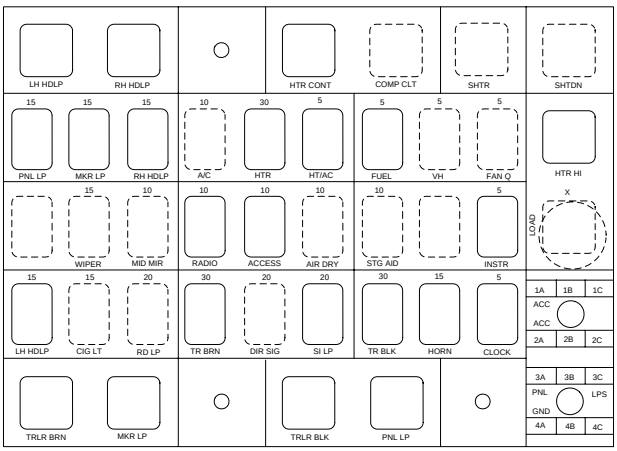
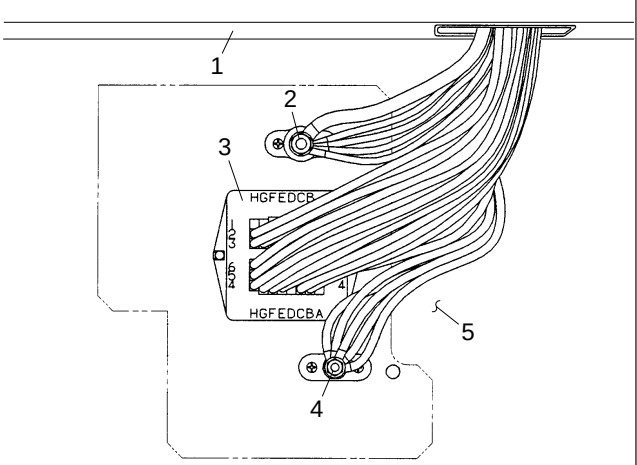


Fig. 5, FLC (LH DR) Electrical Mounting Plate



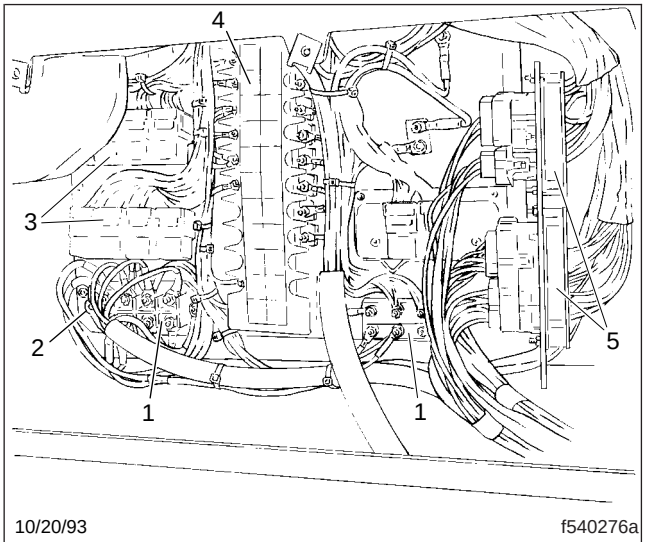
1. Bottom of Dash
2. Main Cab-Power Stud (Red)
3. Main Cab Harness Interface Connector
4. Main Cab-Ground Stud
5. Right-Hand Side of Firewall (Inside Cab)

Fig. 6, FLC (LH DR) Main Cab Harness Connectors

heat. Also check for kinks. Reroute, repair, or replace wires as needed.

⚠ CAUTION

Do not use flat-strip aluminum tie straps for holding electrical wiring. The sharp edges on these tie straps may cause breaks in the wire insulation, allowing the aluminum tie strap to make contact with the wire. This could cause a short circuit and damage to the wiring.



NOTE: Before March 15, 1990, the main cab harness interface connectors were located on the firewall.

1. Junction Block
2. Main Cab-Power Studs (circuit 14 studs on junction block)
3. Relays
4. Circuit Breaker Bus Bar
5. Cab-to-Chassis and Cab-to-Engine Harness Interface Connectors

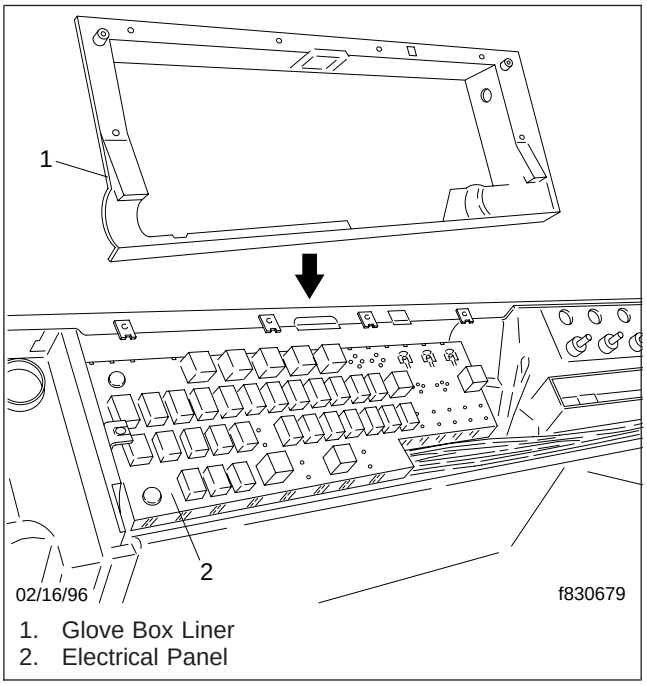
Fig. 7, FLD Electrical Mounting Plate

2. Check all tie straps for breakage and damage. Replace any broken or cracked tie straps.
3. Check the wires of all sensors on or near the engine. Make sure no wires are closer than 6 inches (15 cm) to hot surfaces. If any are, and can not be rerouted, make sure they are protected by heat shields. Check that sensor connectors are tight, clean, and undamaged.
4. On engines with electronic controls, check the wiring and connectors on the computer units.

54–02 Speedometer/ Tachometer Cable Lubricating

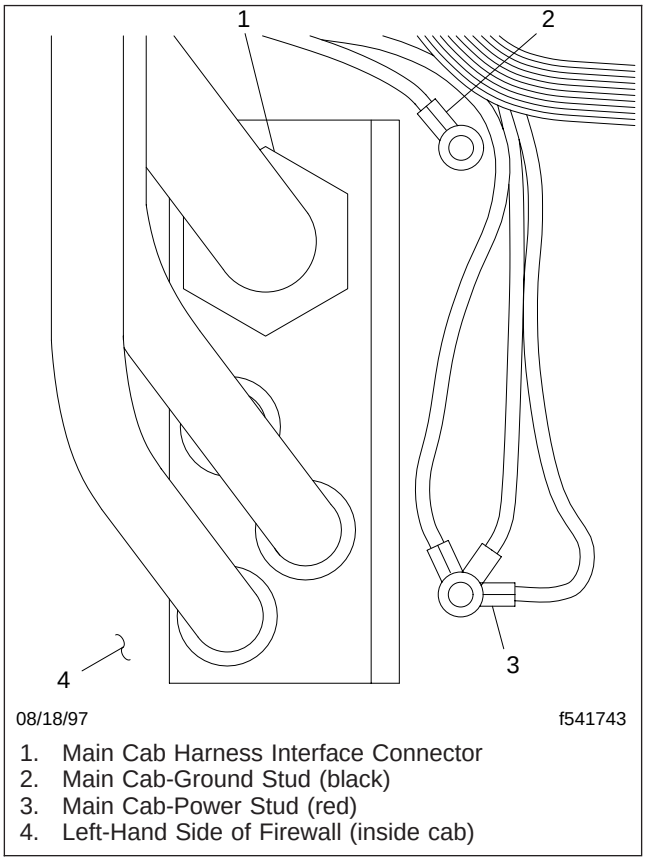
Remove the cable from the housing.

Wash the cable in solvent and wipe it dry. Examine it for breaks, kinks, or frayed ends. Rub a thin layer of Lubriplate on the lower two-thirds of the cable; leave the upper one-third free of grease. Install the cable.



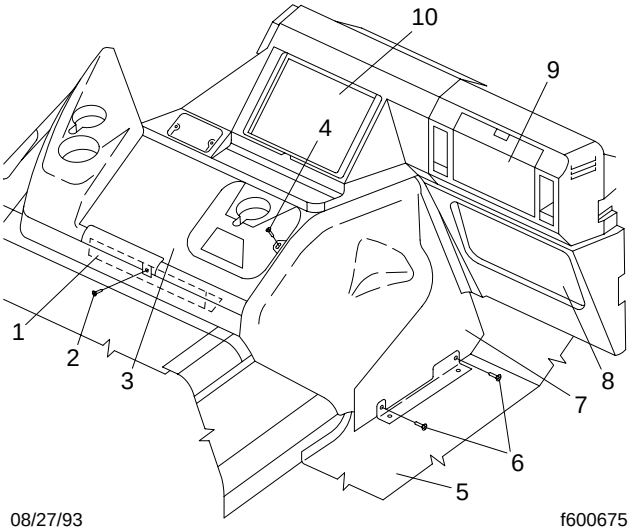
1. Glove Box Liner
2. Electrical Panel

Fig. 8, FLC (RH DR) Electrical Panel Location



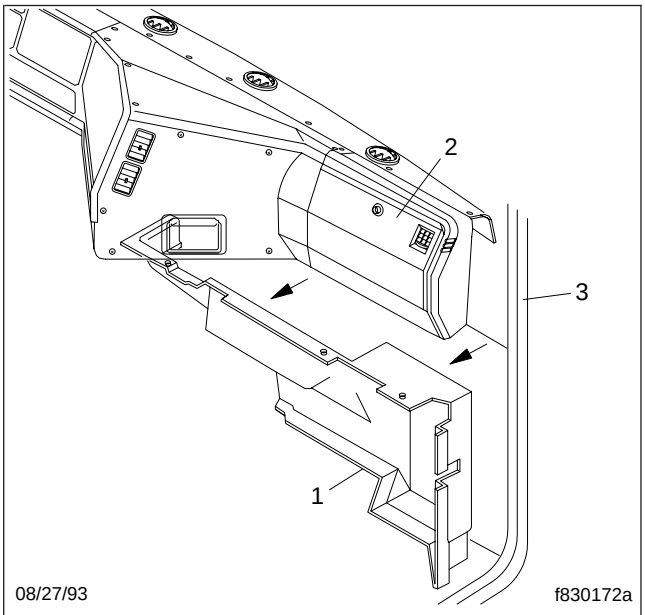
1. Main Cab Harness Interface Connector
2. Main Cab-Ground Stud (black)
3. Main Cab-Power Stud (red)
4. Left-Hand Side of Firewall (inside cab)

Fig. 9, FLC (RH DR) Main Cab Harness Connectors



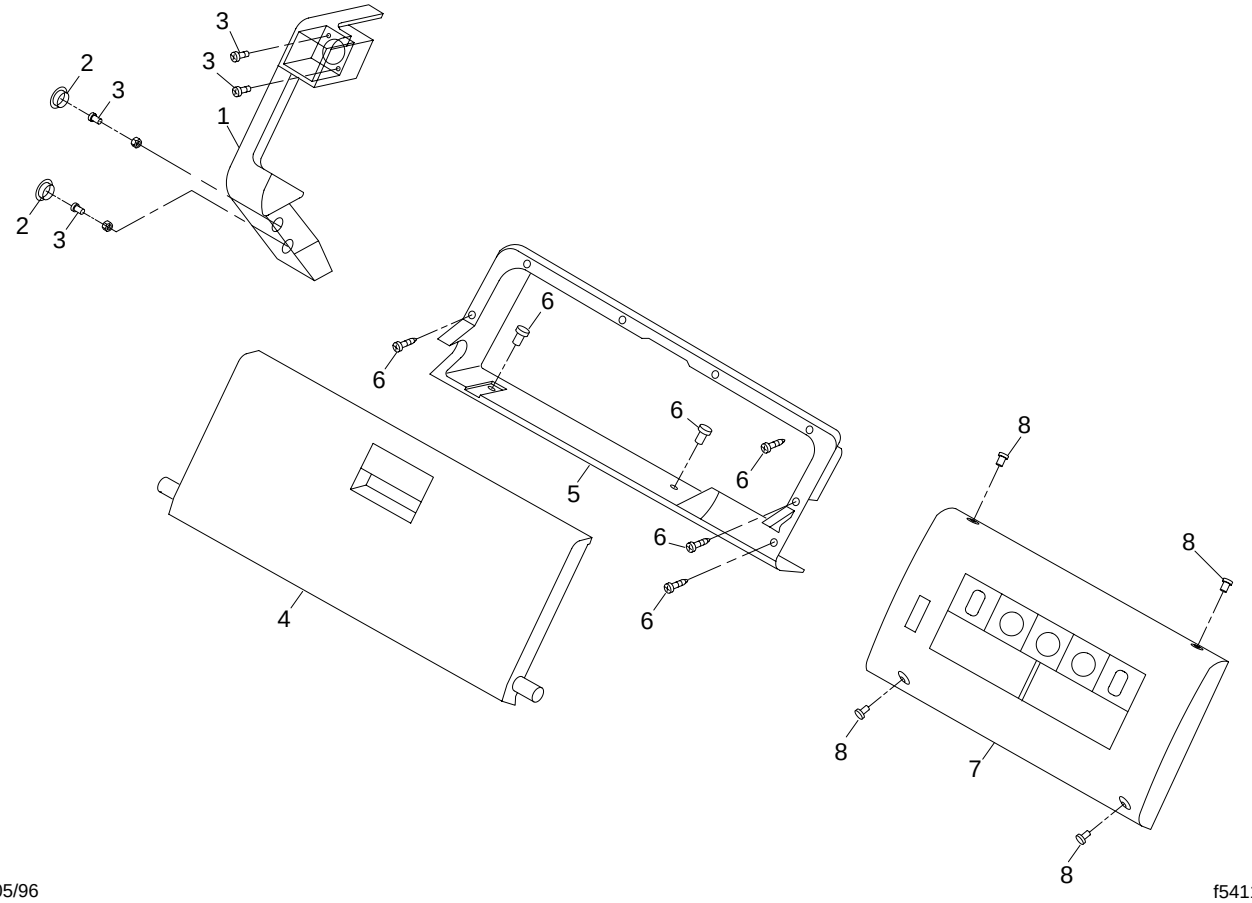
1. Velcro
2. Quarter-Turn Fastener
3. Tunnel Left-Hand Cover
4. Upper Screw
5. Right-Hand Cab Deck
6. Lower Screws
7. Tunnel Right-Hand Cover
8. Combo Cover
9. Glove Box
10. Manifest Box

Fig. 10, FLB Dash and Tunnel Covers



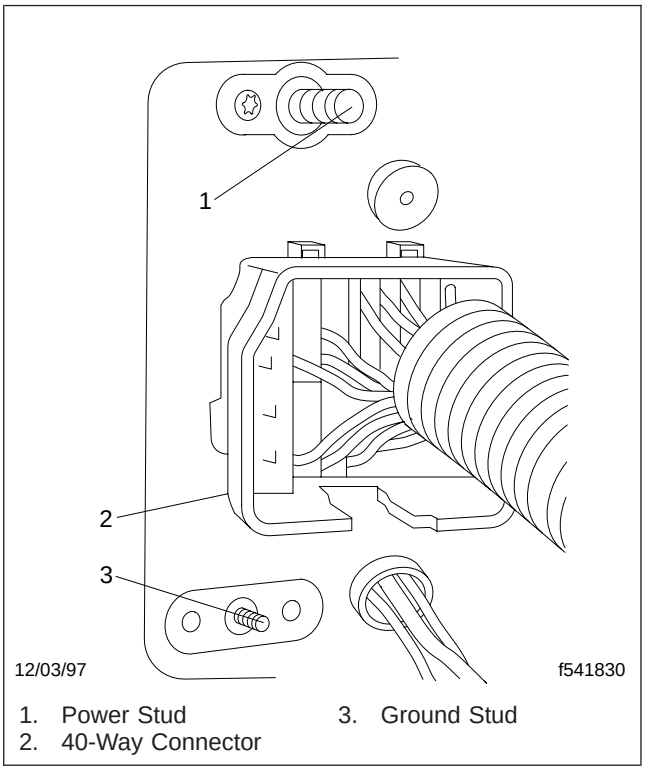
1. Right-Hand Under-Dash Cover
2. Glove Box
3. Passenger Door-Opening Frame

Fig. 11, FLC (LH DR) Right-Hand Dash Covers



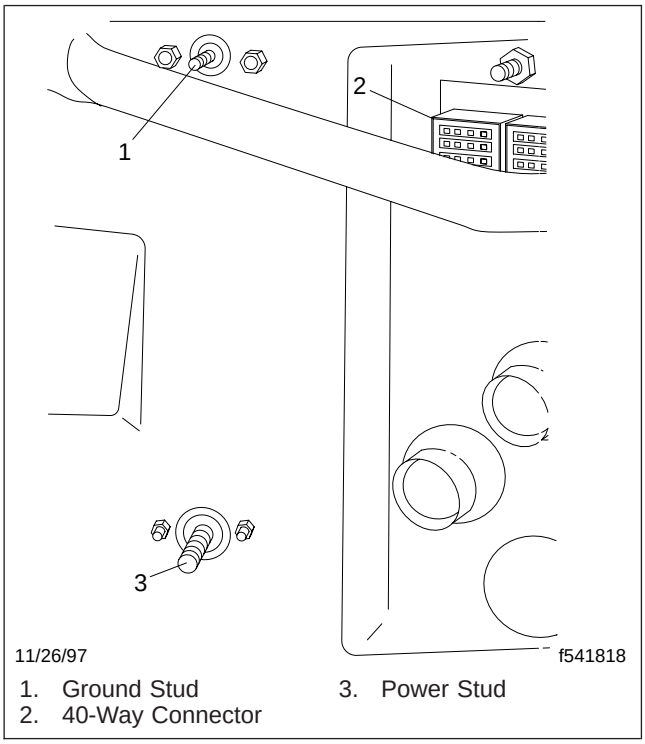
1. Dashboard End-Cap
2. Trimcap
3. Dashboard End-Cap Screw
4. Glove Box Door
5. Glove Box Liner
6. Glove Box Liner Screw
7. Heater Control Panel
8. Heater Control Panel Screw

Fig. 12, FLC (RH DR) Left-Hand Dash Covers



1. Power Stud
2. 40-Way Connector
3. Ground Stud

Fig. 13, FLC (LH DR) 40-Way Connector



1. Ground Stud
2. 40-Way Connector
3. Power Stud

Fig. 14, FLC (RH DR) 40-Way Connector

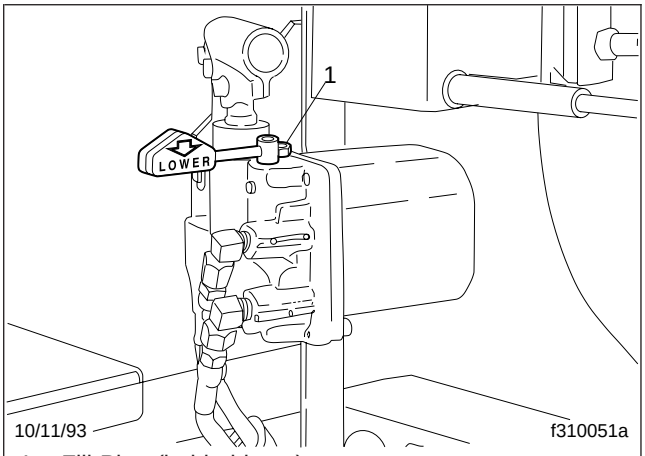
Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Cab Latch Checking, FLA/FLB	60–03
Cab-Suspension Spring Center-Bolt Torque Checking, FLC	60–02
Cab-Tilt System Checking, FLA/FLB	60–01

60–01 Cab-Tilt System Checking, FLA/FLB

Before checking the fluid level in the tilt pump reservoir, the cab must be in the operating position, with the cab latches locked. Let it remain in this position for at least five minutes before checking the reservoir. The reservoir is full when the fluid is at the level of the fill hole. See **Fig. 1**.

If the fluid level is low, check all fittings and lines for leaks. If any fittings are loose, tighten them finger-tight, then tighten with a wrench until there is firm resistance; tighten one-sixth turn more. Replace any damaged or worn fittings or lines before adding fluid. Then bleed any air from the system; see **Group 60** of the *Heavy-Duty Trucks Service Manual* for instructions. Add tilt system hydraulic fluid (MIL-H-5606) to bring the level up to the fill hole. Approved tilt pump fluids are: Texaco 1537 Aircraft Hydraulic Oil 15, Union Arctic Low Pour (-65) Hydraulic Fluid 04617, and Filmite 530 Hydraulic Oil.



1. Fill Plug (behind lever)

Fig. 1, Power-Packer Tilt Pump

A "spongy" feel in the operation of the pump indicates that air is present in the hydraulic cab-tilt system. Bleed the air from the system; see **Group 60** of the *Heavy-Duty Trucks Service Manual* for instructions.

Check for wear of the clevis pin and cotter pin on both tilt cylinders. Check the tilt pump mounting bolts for tightness; see **Group 00** of this manual for torque values for lubricated or plated-thread fasteners.

60–02 Cab-Suspension Spring Center-Bolt Torque Checking, FLC

Check the torque of the cab-suspension spring center-bolt locknut. The locknut must be tightened 85 lbf·ft (115 N·m).

60–03 Cab Latch Checking, FLA/FLB

Check the latch for correct operation. For cab latch adjustment, see **Group 60** of the *Heavy-Duty Trucks Service Manual*.

Index, Alphabetical

Title of Maintenance Operation (MOP) **MOP Number**

Door Seal, Door Latch, and Door Hinge Lubricating. 72–01

72–01 Door Seal, Door Latch, and Door Hinge Lubricating

Lightly coat door seals with a lubricant that is safe for rubber.

Apply a few drops of light engine oil to the door latch mechanism, to reduce noise and wear. Wipe off excess oil. This includes baggage doors, ventilator doors, and the oil check door.

Lubricate door hinges every six months. In addition, lubricate new door hinges at installation. Lubricate the hinges by spraying them with a light coating of silicone lubricant such as WD-40® or an equivalent.

For an FLC, lubricate new access-panel hinges at installation, then once every six months, by spraying them with a light coating of silicone lubricant such as WD-40 or an equivalent.

Index, Alphabetical

Title of Maintenance Operation (MOP)	MOP Number
Air Conditioner Inspecting	83–01

83–01 Air Conditioner Inspecting

⚠ WARNING

Wear eye protection, gloves, and protective clothing when working on the air conditioning system. Leaking refrigerant from a damaged hose or line could cause blindness or serious skin burns.

Preliminary Checks

1. Park the vehicle on a level surface, apply the parking brakes, and chock the tires.
2. Check the appearance of the air conditioner compressor pulley assembly. If the friction surface of the pulley shows signs of excessive grooving due to belt slippage, replace both the pulley and the drive plate. Visually inspect the refrigerant compressor drive belt for damage, and check that the belt is set at the proper tension. Also check the tightness of the compressor mounting fasteners. For instructions and torque values, see **Group 01** of the *Heavy-Duty Trucks Service Manual*.
3. Inspect the drive plate. If the friction surface of the drive plate shows visible signs of damage due to excessive heat, replace the drive plate and pulley assembly. See **Group 83** of the *Heavy-Duty Trucks Service Manual* for removal and installation procedures.
4. On a Sanden refrigerant compressor, use a feeler gauge to check that the drive plate clutch clearance is 0.016 to 0.03 inch (0.4 to 0.8 mm). See **Fig. 1**. If the drive plate clutch requires adjustment, see **Group 83** of the *Heavy-Duty Trucks Service Manual*.

   On a Climate Control refrigerant compressor, place a feeler gauge between the air conditioner compressor clutch and the pulley, to check the compressor clutch clearance. Drive plate to pulley clearance is 0.02 to 0.03 inch (0.6 to 0.8 mm). If the clearance is not correct, see **Group 83** of the *Heavy-Duty Trucks Service Manual*.
5. Inspect the compressor clutch coil wire. Check that the connector is not damaged or loose. Replace the wire if it is damaged.

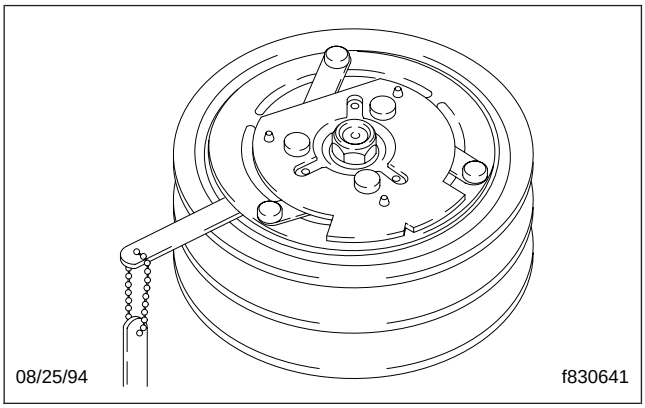


Fig. 1, Drive Plate Clearance Inspection

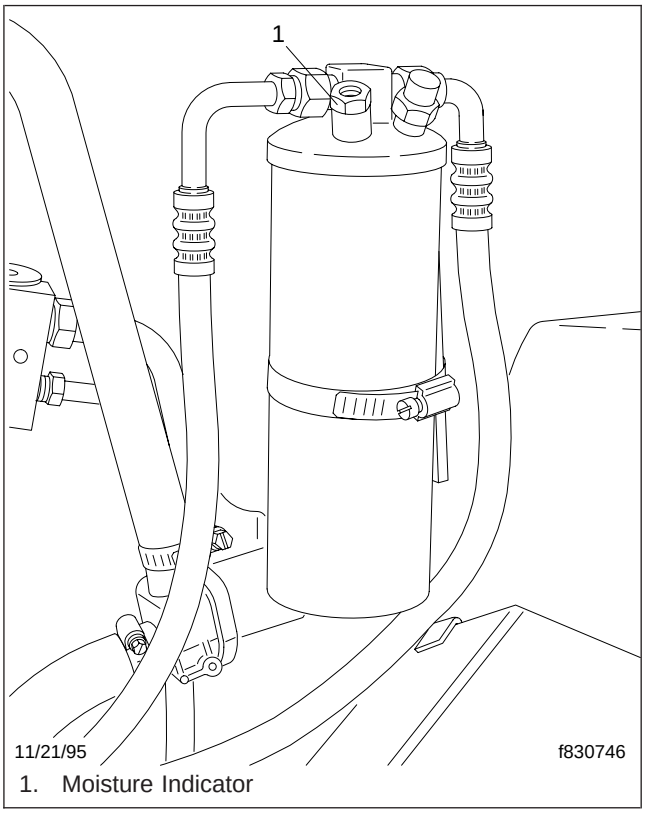
6. Check the overall condition of the air conditioning hoses. Look for cracks, cuts, and abrasions on the hoses. Replace damaged hoses, see **Group 83** of the *Heavy-Duty Trucks Service Manual* for replacement instructions. Also, check for loose fittings on all air conditioning components.
7. Check for a build-up of road debris on the condenser fins. See **Group 83** of the *Heavy-Duty Trucks Service Manual* for cleaning instructions.

Refrigerant Checking

Find the moisture indicator sight glass on the receiver-drier and check the color of the moisture indicator. See **Fig. 2**.

If the indicator is a deep cobalt blue, the refrigerant charge is dry.

If the indicator is *not* blue, the system is contaminated with water. If the system is contaminated, the refrigerant must be recovered and the receiver-drier must be replaced. See **Group 83** of the *Heavy-Duty Trucks Service Manual* for instructions.



1. Moisture Indicator

Fig. 2, Receiver-Drier